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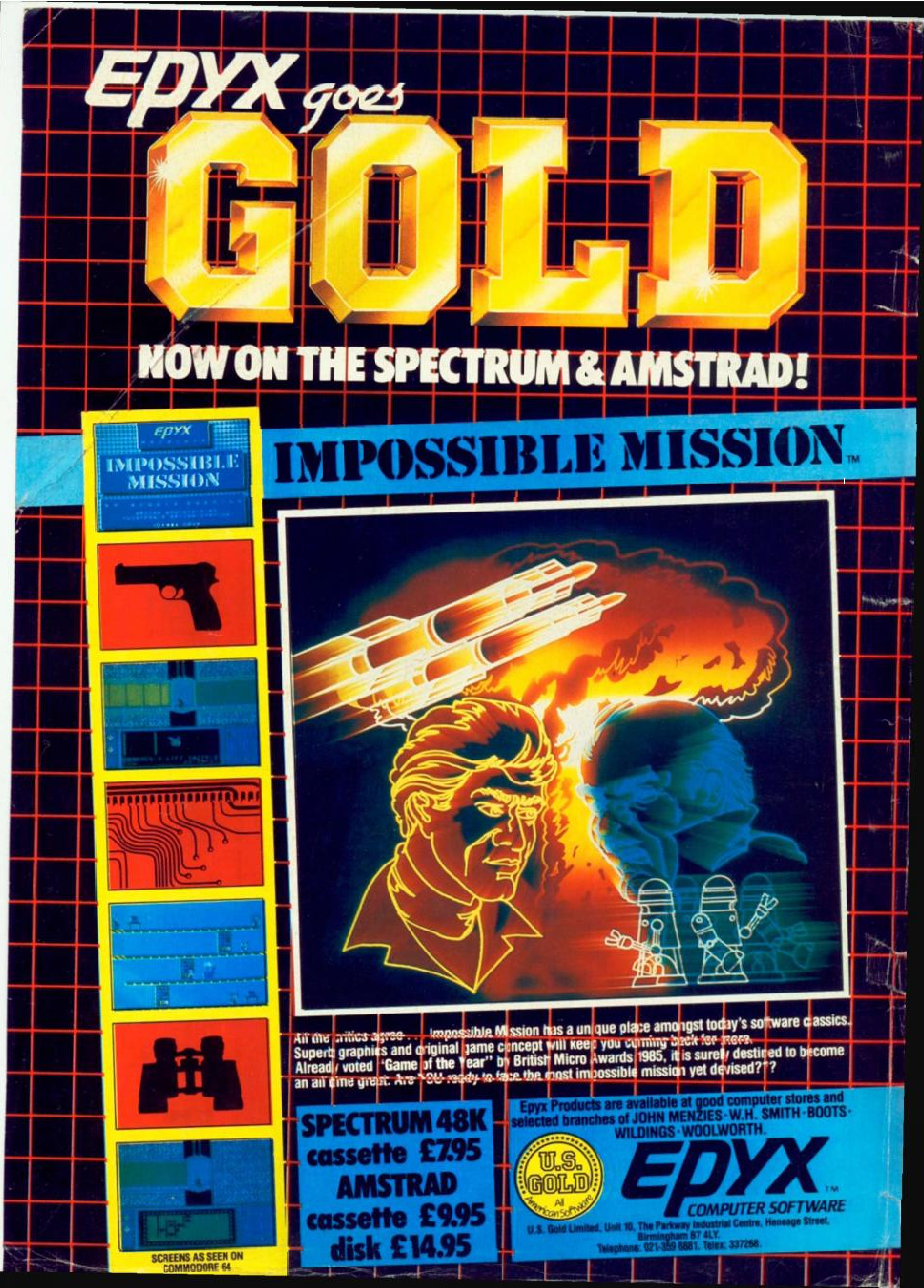
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John Dawson furrows his brow, cups his chin in his hand and squares up to some of the best electronic opponents in a bid to find the best plays.





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Your Computer's survey of sound digitisers by Lee Paddon — plus Roy Dictus's homespun sound sampler for the Sinclair Spectrum. You, too, can be a chipmunk.

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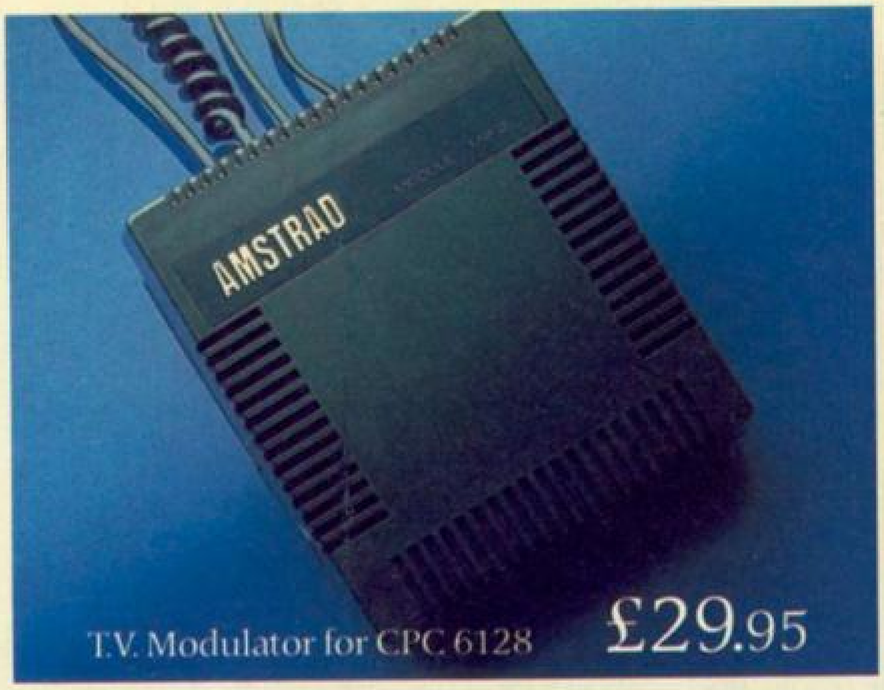
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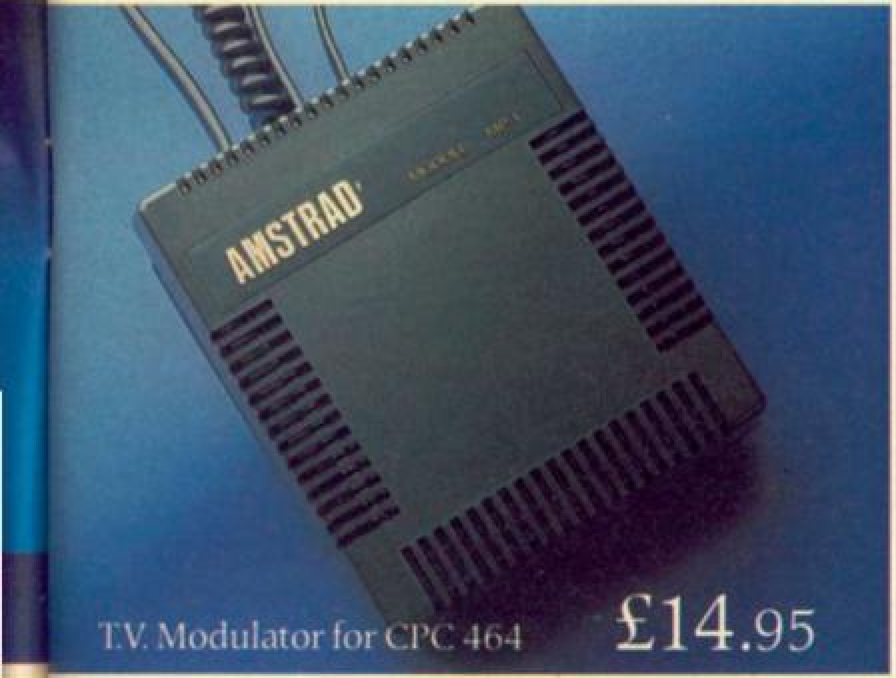




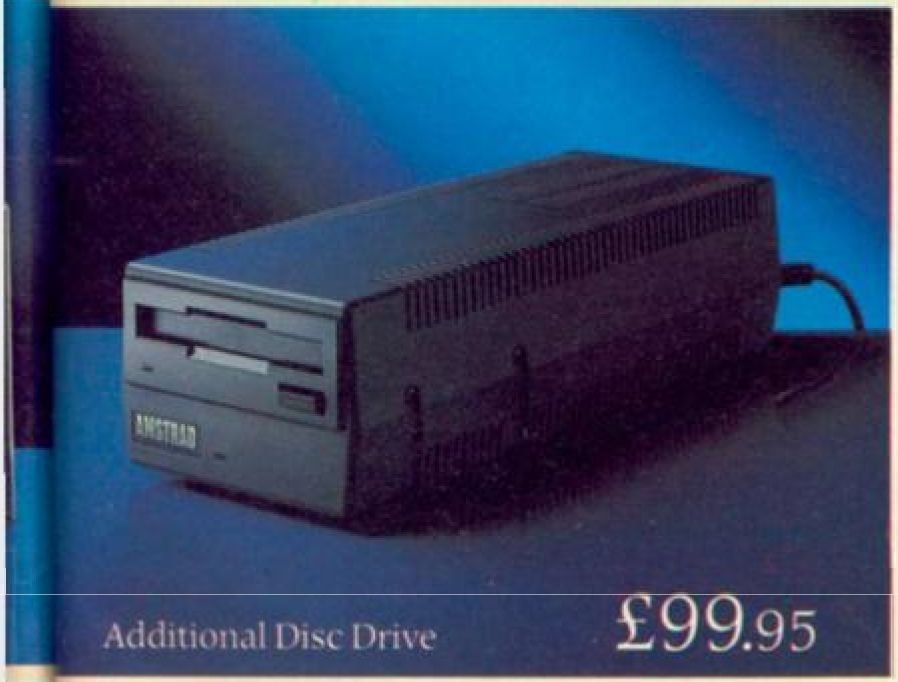


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But games are only half the fun on the Amstrad CPC 464. In fact using it can also be quite an education.

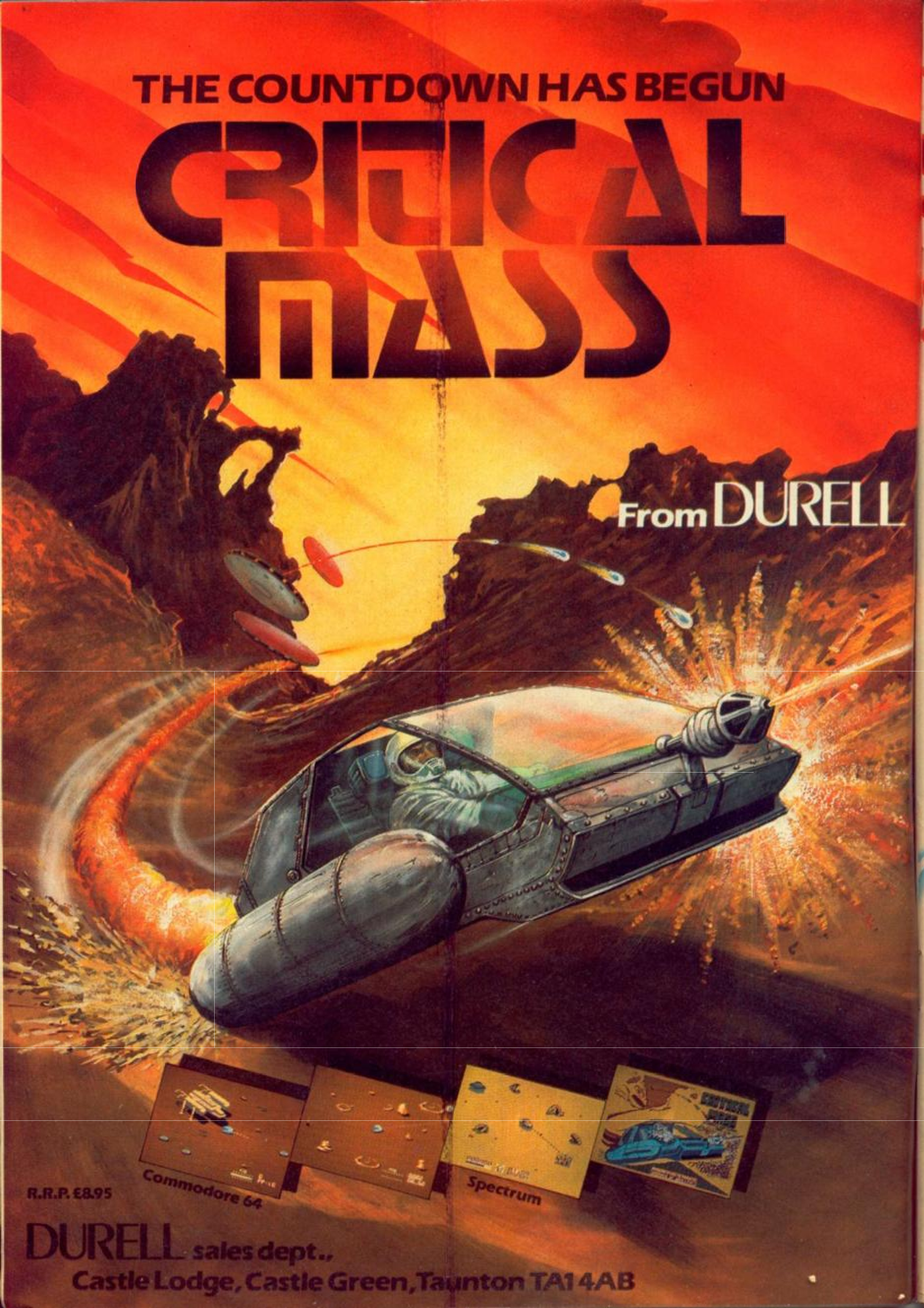
The kids can learn spelling and arithmetic with software like Wordhang and Happy Numbers.

Whilst adults will love the way it helps around the house with budgetting and accounts.

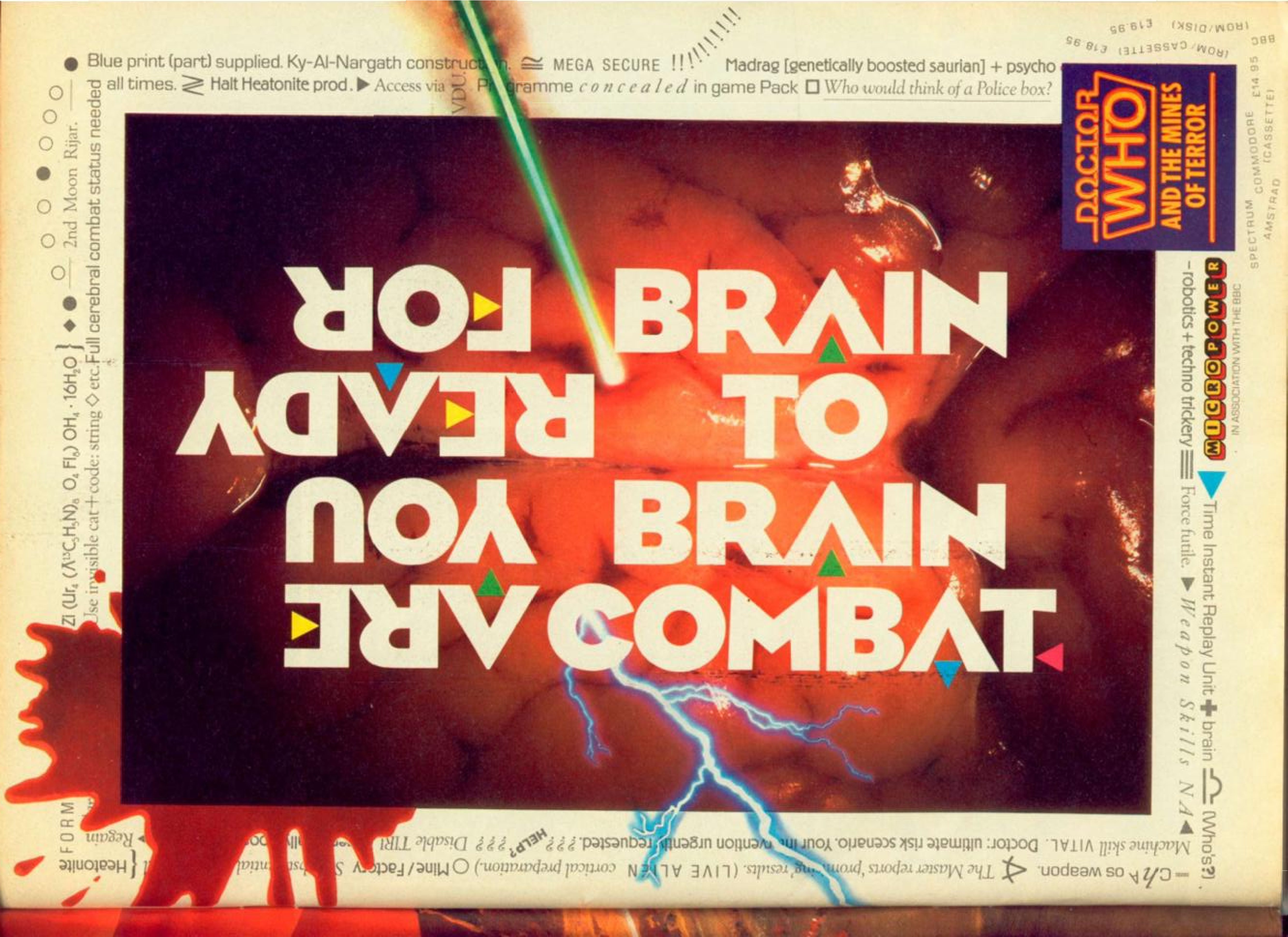


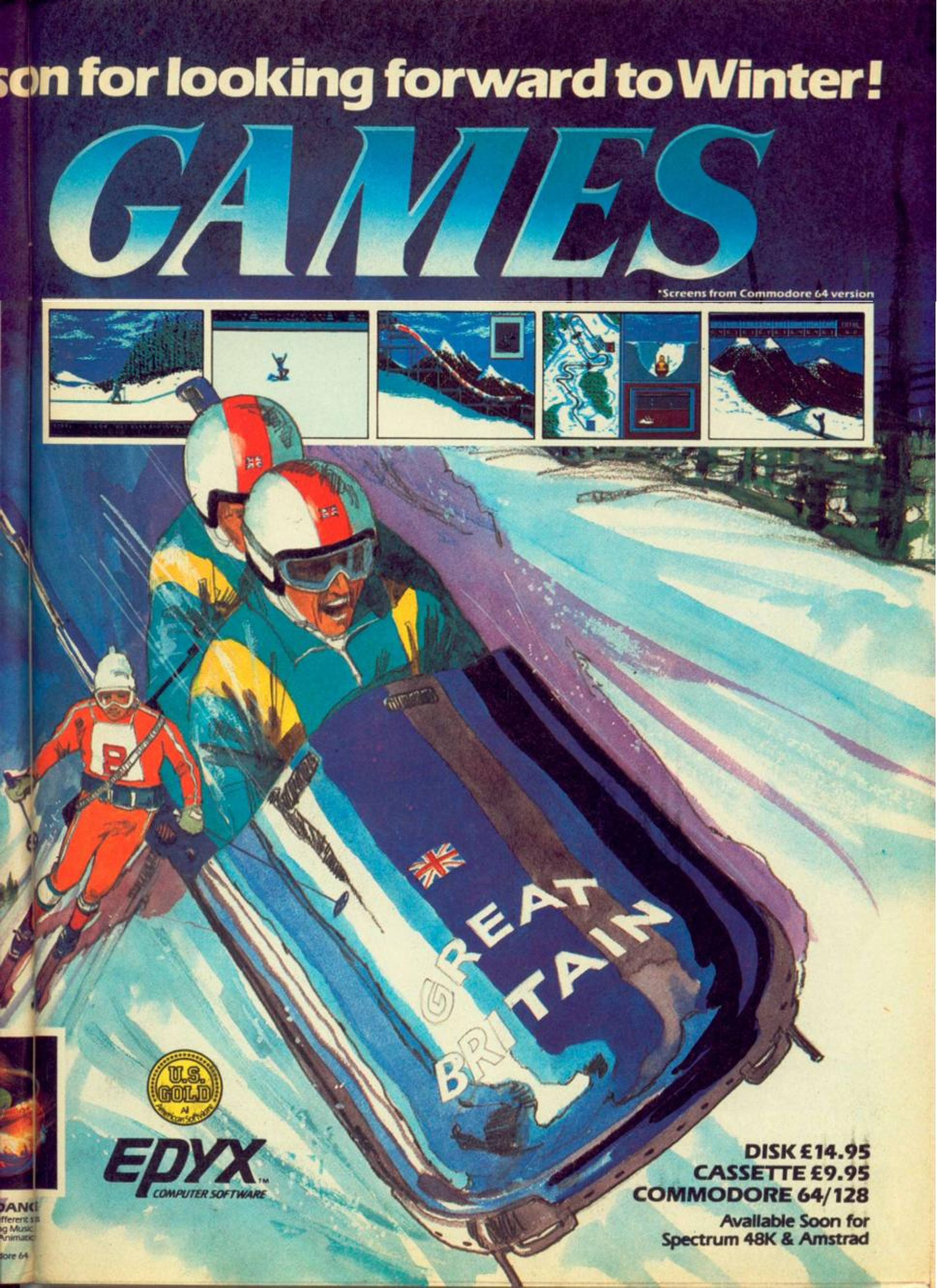
Put the 464 to work and it will take care of a number of business-like functions, such as wordprocessing and spreadsheet.

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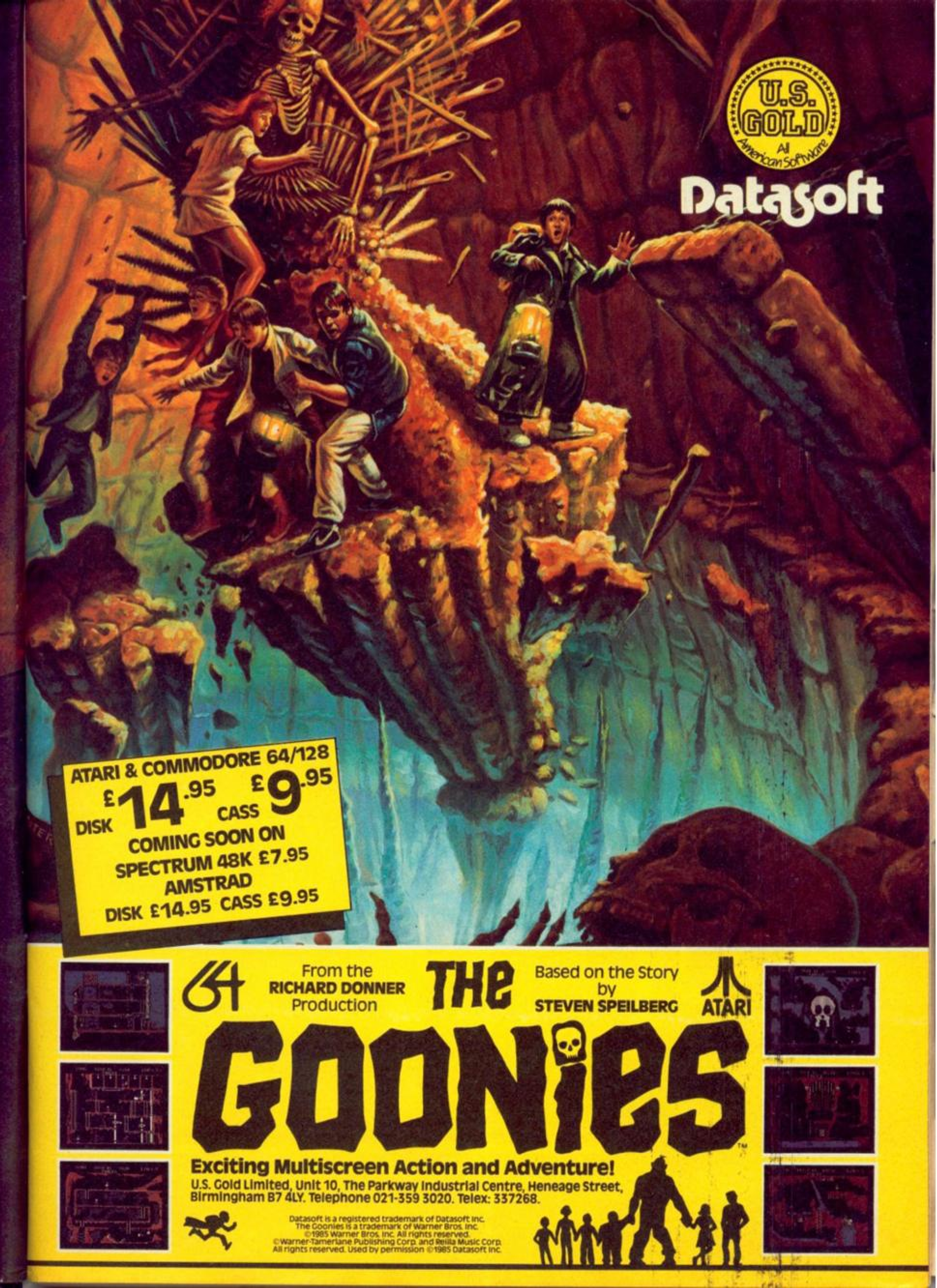


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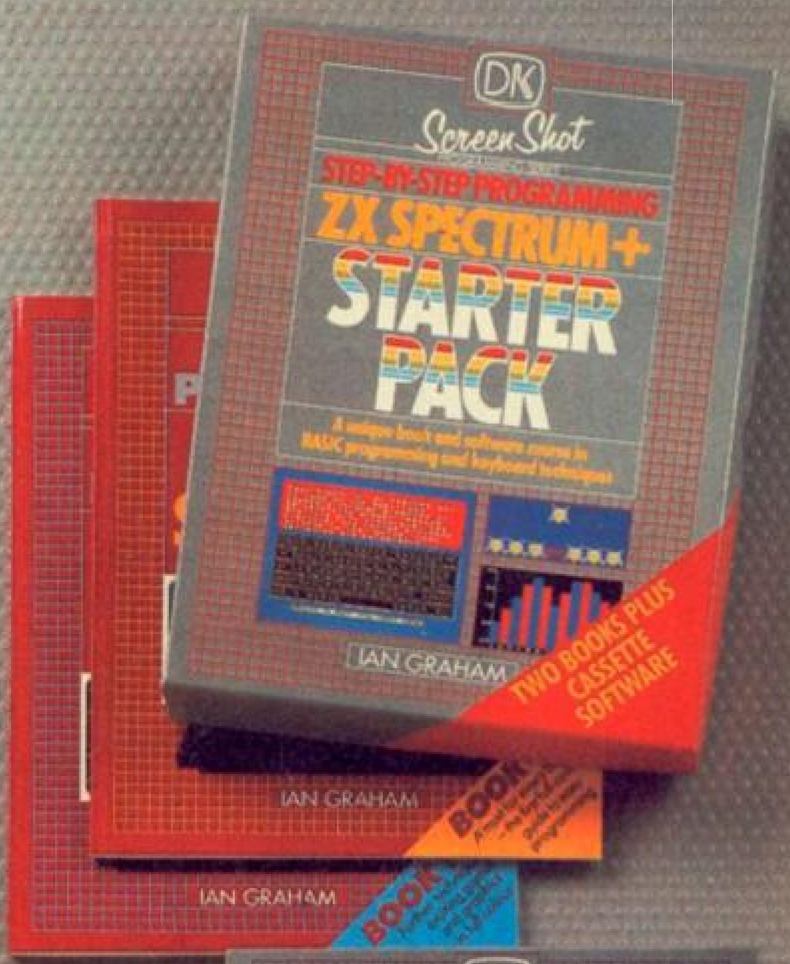
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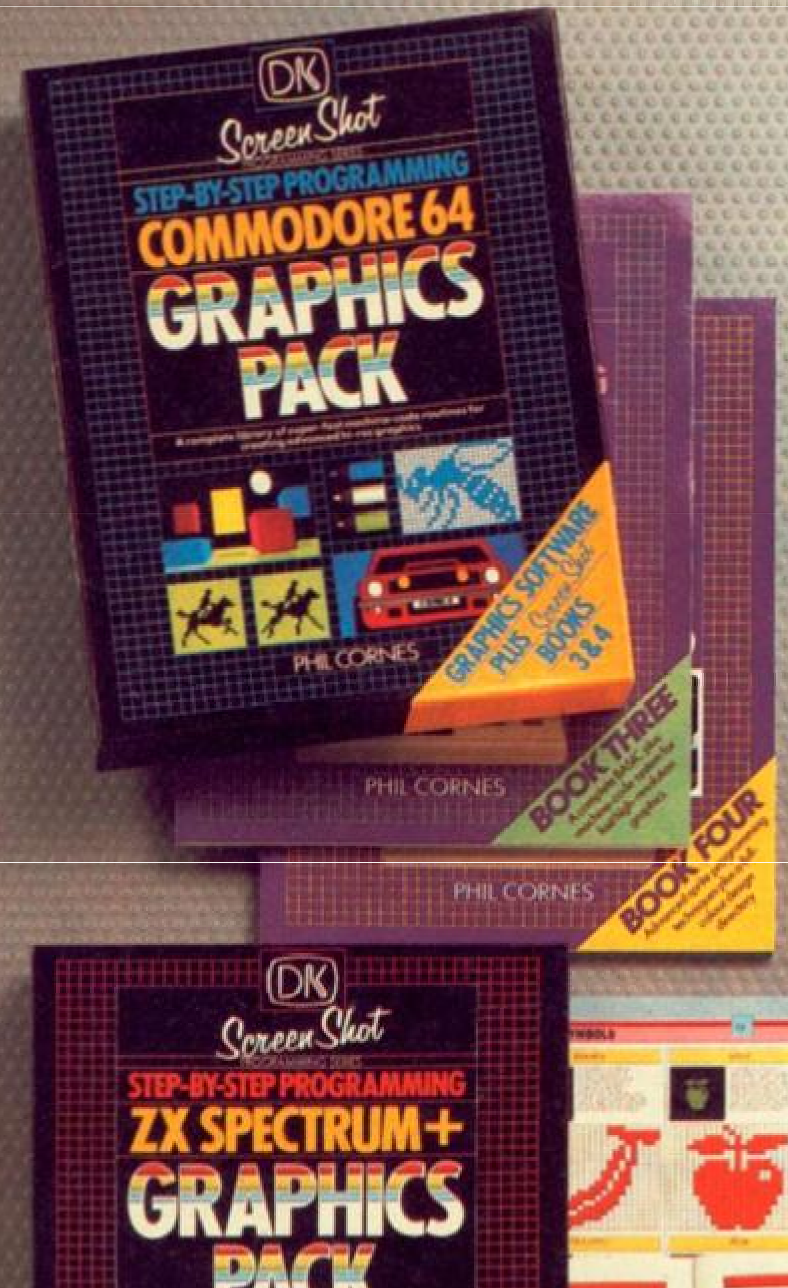


PACKS

GRAPHICS PACKS

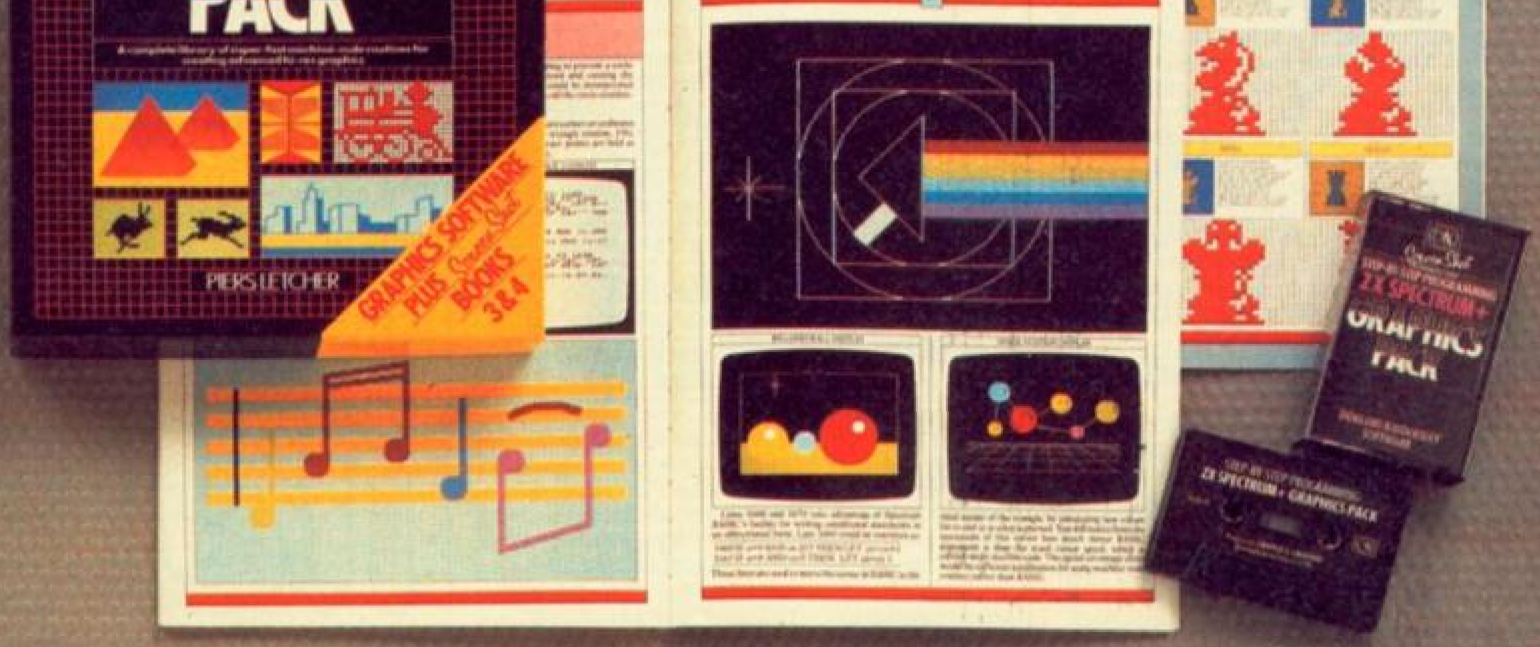
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Edit...

A word from the Editor

EUREKA: MICROS SANS FRONTIERES

ALMOST EXACTLY FOUR years to the day that the 32K BBC model B first beeped to life, Acorn has stopped manufacturing it for the U.K. market. In contrast the excitement the machine caused when it first appeared, it has been quietly slipped out of production with Acorn reluctant to admit the fact.

Of course you'll still be able to pick up a 128K BBC Plus or the 64K Plus offered with a £30 64K upgrade.

Despite its £400 price tag, and thanks to its high performance, solid construction and the vitally important "BBC" badge, the model B became the standard computer for education. It has also kept thousands of home and professional users happy for years. Obviously the larger memory BBCs will try to satisfy those markets for the immediate future, but what is Acorn planning to do to maintain its dominance of the educational scene?

The answer may lie in Europe's Eureka project. It's difficult to be more definite than that because even the European technology ministers concerned don't seem to be too sure what Eureka is.

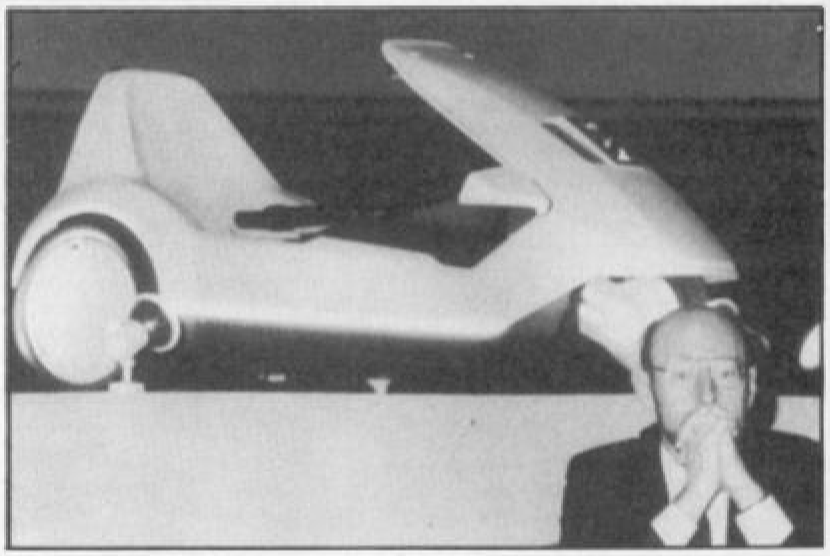
What is clear is that it's going to be some kind of scheme for high-technology cooperation. And one of the 10 projects to get the OK from the foreign and technology ministers assembled in Hanover recently is Acorn's venture with Olivetti and French electronics giant Thomson. The aim of their scheme is to develop a European standard for educational computers.

The French started the Eureka ball rolling when President Mitterrand proposed the scheme as a European antidote to President Reagan's Star Wars project.

As we reported in our October edition Eureka could lead to a joint European standard for "home information and entertainment" — the Eurohome project proposed by Britiain's Department of Trade and Industry. Let's just hope that if it does come about it proves more of a threat to U.S. and Japanese markets than MSX computers.

Starring

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C5 and you've seen the lot

Just as the "official" biography of Sir Clive arrives — The Sinclair Story by Rodney Dale — the great man's tricycle company has crashed again. The holding company, TPD, which took over from Sinclair Vehicles has gone into liquidation with debts of £1 million to creditors other than Sinclair. He has lost £8 million on the C5 and other electric vehicle projects but will get first grab at the £500,000 assets of TPD.

Rodney Dale was given access to company archives when he was writing his book and the result is that he has become closely involved with his subject. He spends much of the book on Sir Clive's early life in the electronics business and the flat screen television. There is a little analysis of why someone who could single-handedly create a market for home computers in this country should repeatedly be involved in a series of marketing and manufacturing disasters with digital watches, calculators, flat screen tellies and now the C5.

Dale confesses to being surprised at the failure of the C5. His memories of the launch day back in January at Alexander Palace are very different from those who insisted on taking the trikes out of the heated hall into the real world they were supposed to be designed for. The danger and unreliability of the C5 "bobsleigh" were immediately apparent as journalists found themselves hurtling out of control down ice slopes, almost disappearing under the wheels of lorries and having to pedal back up the hill after their motors overheated or batteries failed. A new and decidedly unnoficial biography is due out soon.

New Einstein is it a Bohr?

Tatung admits that it is working on new models for next year but insists that new Z-80 machines will be "downwards compatible" with the Einstein, the 64K micro which with colour monitor and disc drive costs £400 not £500 as we said last month. New machines will have 80 column display, stereo sound and a choice of 128, 256 or 512K memory.

Meanwhile new products on the way for the Einstein include a £30 music package and a similarly priced transformer box which will allow the Einstein to run Spectrum programs.

Hard News

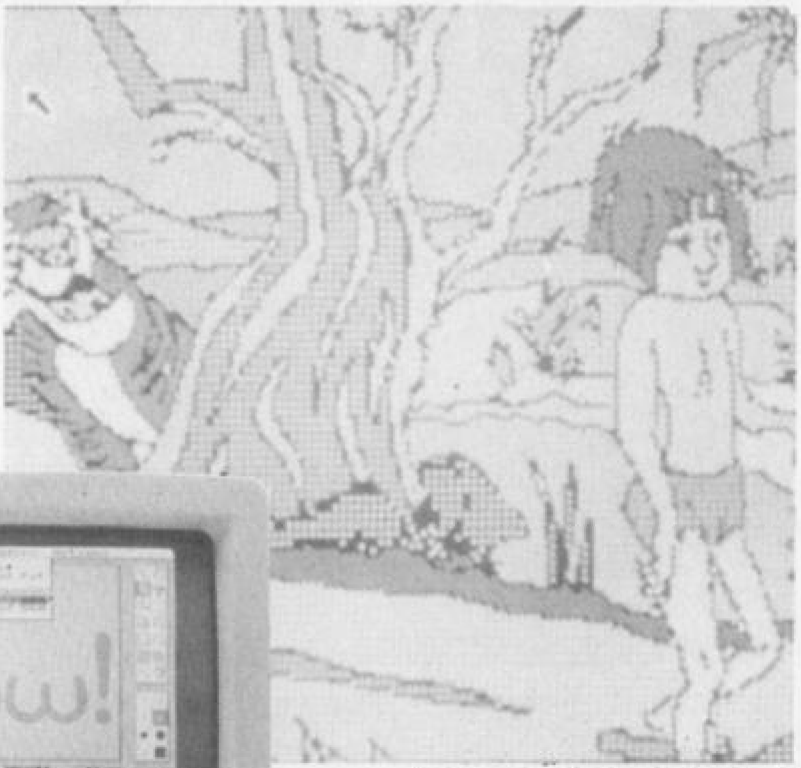
NO NEED FOR 16 BITS

Acorn is putting a brave face on its absence from the High Streets this Christmas for the first time in four years. You may find some Electrons in Dixons — part of the job lot picked up in the Summer but everyone has given up on selling the BBC Micro.

Acorn now admits that the 32K BBC B has been discontinued but against the odds it still insists on trying to sell the BBC 128 without disc drive or monitor for £500. It seems a shame that Acorn has opted out just when companies like AMS with the AMS mouse are extending the frontiers of the BBC to make it a 16-bit WIMP look-a-like.

AMS has introduced a £50 Pagemaker program which allows you to compose a complete page of a school newspaper for instance on a screen including graphics and photographs. There are 16 different founts which give a limited but interesting variation in typeface. The typesetting is crude as you would expect — it justifies but not proportionately — but effective.

Digitised pictures can be loaded and then altered on screen. Another new package for the £40 AMX mouse is the £50 Super Rom/Art program which gives the AMX mouse pull-down menus overlapping colour windows, patterns and an icon in all modes.





'Amstrad piracy' — both sides claim a win

Selling tape copying equipment not unlawful

Amstrad fails to win audio approval

Who is winning the piracy battle between Amstrad and the British Phonographic Institute depends which paper you read. The problem for BPI which fights copyright evasion was that the double speed tape-to-tape machines sold by Amstrad were being used to copy commercial music — and computer — cassettes. Amstrad sought a declaration that they were legally in the clear but the High Court refused.

When Amstrad appealed at the end of October *The Times* ran its law report under the headline "selling tape copying equipment not unlawful" while *The Guardian* went for "Amstrad fails to win audio approval". The truth seems to be that the Appeals Court ruled that selling products that could be used to infringe copyright was not illegal as such but that promotional material which encouraged breaking of copyrights could causes the crime incitement to break the law.

DIARY

Bruce's friend Sir Keith Joseph is thinking about closing Keele University which is sad. Bruce you may remember last month argued that Joseph ought to be promoting serious software which is just what the Department of Psychology, at Keele is doing as part of a three year project financed by Rowntree Trust to produced software for mentally handicapped people. The first arcade game designed for the handicapped, Mr Ugh, has already been developed and if you want to find out more about what the Keele Psychologists are up to contact John Hegarty, University of Keele, Keele, Staffordshire.

Acorn's enthusiasm for £1,000,000 order for the BBC from Canada is understandable but it is a small return on the £8 million or so which the company sank into the North American market and which directly led to its collapse and takeover by Olivetti.

Tatung is still smarting from the exposure of its no smiling

(continued on page 23)

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Soft News

(continued from page 21)

or laughing policy at the Bridgnorth factory where Einstein micros are made. Now the company is saying that the Taiwanese management only meant the workforce to have a serious attitude when using dangerous machinery.

Our very own Bruce Everiss finds himself in hospital to have an overgrown pimple removed from his face. I asked around the office for suggestions for a computer game to send to keep him happy while he is in. "Wetzone" suggests one cynic "Superhuey" is another idea but most vote for "Way of the Exploding Cyst".

British Telecom's MUD may still be glorious but it is certainly going to be late. The Multi-User Dungeons were going to be officially launched at The London Dungeon — where else? — on November 5 but the blue touch paper is still smouldering because BT cannot find enough spare computer capacity at the moment. The Great MUD Challenge has now been delayed till the New Year.

The people next door are away overnight. Their cat jumps on to their television — as cats are wont to do — which is connected to the computer which is connected to a printer and a disc drive and a modem. Ever careful your neighbours have bought the Product Innovation Spider alarm which is like an octopus with sensitive tentacles that has lots three of its legs and so can safeguard a home computer system from theft. The cat meanwhile starts playing with the wire unaware that "any slight movement of the device will sound the alarm". Result — one scaredy cat and a sleepless night for you as PI reckons that the Spider will let off "an ear-piercing 98 decibel scream" for two hours.

Elsie Dee

U.S. GOLD LATEST



Accolade Inc is the newest bright star in the US software firmament. Founded by Alan Miller and Bob Whitehead — both former Atari and Activision pioneers — the company aims to produce high-quality graphics, lifelike games and generally knock your socks off. Thanks to US Gold, the first of these apparently revolutionary programs Hardball for the CBM-64 will be released in the UK in January 1986.

Billed as the most realistic home baseball game ever, it has large lifelike players and three-dimension field views.

US Gold puritans may run a light pencil through some parts of Accolades's raunchy Law of the West, a very funny text-and-graphics adventure.

The third prong of the Accolade assault is PSI-5 — an Elitesque space trade'n zap.

Little People

Many people faced with inexplicable programming problems blame the difficulties not on their own fallibility or obscure operating system bugs but on "little people" living in the machine.

Activision is exploring the widespread belief in Gremlins with its tacky Little Computer People Discovery kit on the Commodore 64. As you would expect this is just a simple game based around a 2½ storey house. Each of the characters is different but according to Activision's Hugh Rees Parnell — who we are assured is real and not a figment of our imaginations — "they share common attibutes such as the need for care and affection, a remarkable aptitude for playing games, the ability to communicate and a love of music."

Activision obviously hopes that Little Computer People will be this year's Cabbage Patch Kids or Pet Rocks. They are giving away deeds of ownership with every hit sold.

QL draw

Impressed by the graphics on Psion's QL Chess? You won't be once you have Psion's Q Draw which allows you to create images using Psion's in-house graphics program.

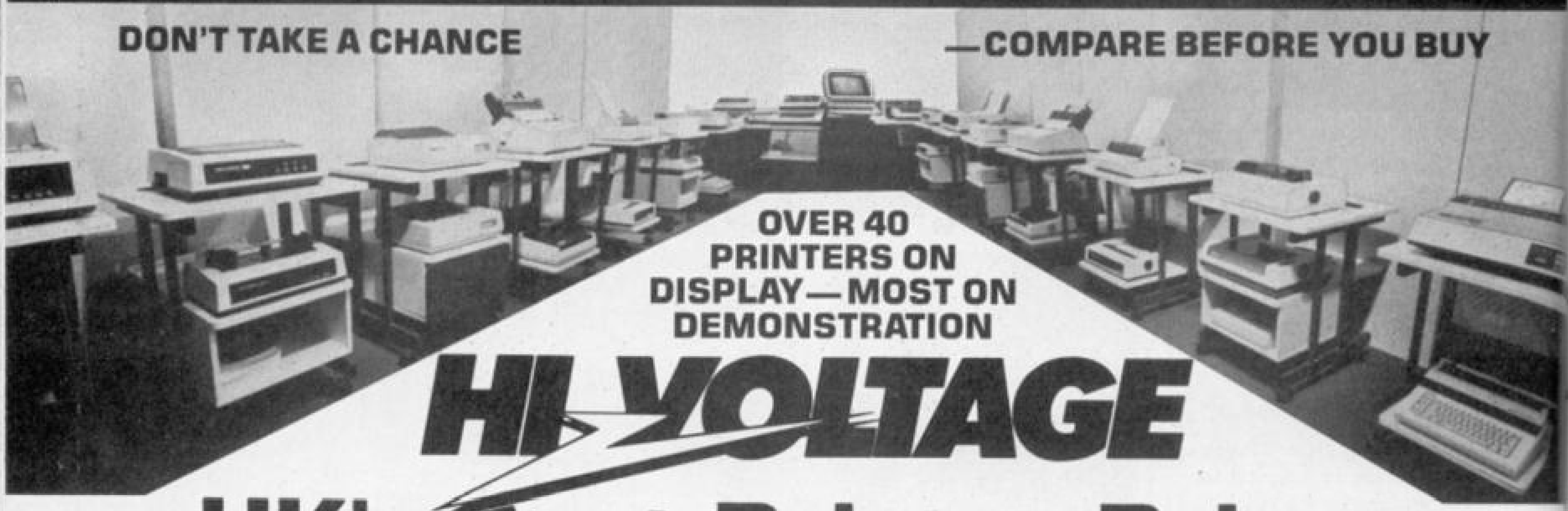
For £15 Q Draw includes a library of useful shapes and allows you to use "pens" of different thickness on screen. Back with Chess Psion claims that the algorithm their program is based on — written by Richard Lang — is still world champion. But Kasparov need not worry yet. Lang's algorithm can still be beaten by good club players let alone Grandmasters.

Fun house

Ozisoft does not sound like a real name — even for an Australian software house, but CRL claims to have brought Journey, an £8 treasure-hunting game for the Commodore 64, from Ozisoft. Journey features music based on Madness's House of Fun, multi-directional scrolling and hundreds of location.

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MEMOTECH IS BEST

In light of the new price cuts the Memotech machines must be the best value on the market — British built, 32/64/128K user + 16K video, 4 channel sound, 32 sprites, 8 widows, fast and powerfull Basic, Noddy — new text-handling language in Rom — assembler/monitor, 16 colours, CP/M, very attractive brushed aluminium casing, superb networking, expandable to 512K internally, plenty of provisions for discs — from floppy to silicon, and much, much more.

And don't forget Memotech's attempts to rid the shortage of software by creating — an industry first — the Speculator Rompak which allows a large base of new Spectrum hits to run on the MTX machines.

The tech. spec. of the MTX + it's new prices (MTX500 — £79, MTX512 — £130, and RS128 with twin RS232 — £249 makes it worth a mention.

Avid MTX user,
Lancashire.

Dear Jeff Minter,



Whenever you appear at exhibitions you are surrounded by throngs of acolytes and groupies. They are easily recognisable by their sixties Haight Asbury appearance and by recurrent strange animal motifs. To be quite blunt you are the biggest cult in the micro industry. Now you have a new fan. Me. And I don't even like your games.

While it is fair to say that you know how to program, it is also fair to say that you couldn't market your way out of a wet paper bag. It must be infuriating to see inferior products to yours selling in much larger volumes, cult or no cult. Ariolasoft, on the other hand, probably think a stack pointer is part of a fork lift truck. This hasn't stopped them marketing themselves to the top of the software house tree in less time than it takes to format a Sinclair Microdrive cartridge.

You relationship with Ariolasoft is one of the most sensible events this industry has seen for some time. Adam Smith's divisions of labour proven once again. Both parties benefitting from the other's abilities. True synergy where the whole is greater than the sum of the constituent parts. It is this that has made me a fan.

The Llamasoft/Ariolasoft honeymoon epitomises a trend. Success has increasingly come to those who know what they are. Either programmers or marketeers. Those who try both are a lot less successful. Jack of all trades and master of none. Many who have tried to do both are, unfortunately and somewhat inevitably, no longer with us. Some, luckily, still are. These are the people who should follow your example in order to survive, never mind succeed. Prime among these people are Ultimate. If they wish to continue as a viable entity they have to decide what they are.

Tim Stamper and his gorgeous sister Louise have been the major games software trendsetters. They have produced more influential products than any other software house. Yet their sales, large though they may have been, have never reflected the true merit of their products. Like you they have seen inferior products to theirs sell in larger volumes. Like you their weakness is not in the programming but in the marketing. They make simple mistakes like putting insufficient perceived value into their packaging, making them the most pirated out of all the software houses. It is about time they realised what they are and acted accordingly.

For a small fee I would be only to glad to put Ultimate in touch with the company best suited to market their products.

Bruce Everiss

Bruce Everiss.

IN TOUCH

How to write for Your Computer

We called this magazine *Your Computer* precisely because we welcome you views, tips and hints and even your criticisms of machines and software in general. Here's how you go about getting you name into print. Your article should be typed, double-spaced, on A4 paper. A name and address on each sheet would help. Don't forget to tell us which machine it runs on. With programs please include a cassette or disc and some indication of how long it is. Please put what machine it's for on the envelope. Don't forget full instructions to us how to load and list your program and how to enter it for the readers.

The article must be submitted exclusively to *Your Computer*. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

Telsoft

Telsoft is *Your Computer's* software downloading service. Any program for the Spectrum or the BBC and the Commodore which has a telephone symbol next to it is available on the service. Both 1200 and 300 baud speeds are catered for. For more details call Colchester (0206) 8068. No more lonely nights typing in hex.

Message service

You can get messages to us in two ways. Either use the Prestel Telex Link to 892084 BISPRES G or you can use our very own modem, day or night on 01-661 8978. The modem is V21, 300 baud, even parity, 10 bits per character. You simply transmit in upper case "YRC" — our address code, and wait for the acceptance code "+ + + STF GO". Then off you go. Don't forget to tell us who it's for. Sign off with "NNNN" — again in upper case.

XMAS MICRO

I'm not often moved to writing but after reading November's *Your Computer*, I feel I must point out a few errors in Lee Paddon's article about possible micros for your Christmas stocking. For in that article he states that the Enterprise has very little software and most of them are poor conversions.

While at the time of that article being written there might not have been many available — this is something that has since changed. Saying that they are mainly poor conversions could not be further from the truth. In fact 95 per cent surpass the originals in both graphics, sound and speed. If you are wondering why so many of the

(continued on page 27)

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Normal prices for BBC/CBM 64 product is £8.95 except for Jungle Jive and Falcon Patrol £2.99.
Spectrum product is £6.95. The following games £2.00 off at £6.95, or £5.95 each if something else purchased:
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Don't forget to enclose your name and address, vouchers and payment with your order. Cheques or postal orders payable to Virgin Games, should be sent to:

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Your letters

(continued from page 25)

titles are conversions, it is because they are so easy to transfer.

For example, the screen can be made to simulate the Spectrum screen right down to being at the same address and pixel layout. Even attribute clashing occurs if a straight dump version is made. Another point is Enterprise has never claimed that it can run MSDOS. All it has ever claimed is MSDOS file compatibility, that means reading and writing MSDOS files and not running MSDOS programs. Any claim that it will do so is a complete fallacy.

T J Box,
Independent Enterprise User Group

DRAWER BUG

Thank you for publishing my 'Drawer' program in the November issue of *Your Computer*. I have, unfortunately recently discovered a bug in the program which causes use of the "Text" mode to corrupt the long-term store. Corrections are as follows:

Load the code then;
POKE 28908,191
POKE 29221,191
POKE 29222,6
POKE 29235,191 then SAVE "DRAWCODE" CODE 25000,5512.

This applies only to the program as you publish it, not to the tapes which have been bought directly from myself. Apologies for the inconvenience.

P A Rhodes,
Luton,
Bedfordshire

REVIEW VIEW

I would like to make a few comments which relate to Colin Grant's letter in the September issue.

The Spectrum Microdrives are excellent and do compare with some disc drives in performance. I have never lost any data or program kept on them and a recent development project that required me to use them just re-inforced how good they are.

The original QL review stated that the hardware was the best value yet, but I was very concerned about the software. The QL hardware has been further improved and is perfectly satisfactory, the software also still has one fundamental fault.

The saving and loading times of Basic programs are very poor when compared with the Spectrum, there should have been a routine developed by Sinclair and put in later Roms to enable saving and loading at Spectrum speeds. Although QL floppy discs are quicker, they still do not compare with the Spectrum speeds which is a great pity as virtually all the QL problems are related to this one fault.

It is helpful to see a response to the reviews, good or bad, as it enables me to continuously update the criteria I use to evaluate the machines, and it informs me of any blind spots or prejudices that I might have.

Finally, remember it is only my opinion, based on a standard set of tests that I have developed and apply to each machine reviewed. The object of the exercise is to inform the reader of any shortcomings, extra facilities and of the perceived value for money. On a low cost machine, the fact that their are omissions is not surprising and should be taken in context.

K D Peel.

AMSTRAD TALE

Just thought I would relate a tale of one computer user who is not only happy with the machine he bought but who is over the moon with the after sales back-up which is available. The machine is the Amstrad CPC 6128.

I was one of the original ZX81 owners (well I was looking for something to run my power station for me).

Even as I type this, I recall with horror the days I spent trying to get through to Sinclair's one, permanently engaged telephone line, only to be told when successful that I had got the wrong department and could I try another number...four days later I finally got through to the right number only to be told that there was nothing wrong with the Rom — perhaps I should see a psychiatrist instead — I had a perverse satisfaction when some time later they had to admit that there was a fault in the Rom and had to replace half a billion or so that were in circulation already at their own expense. Never mind, after learning the hard way, I vowed that I would postpone upgrading to a better machine until I was certain it would be the right one.

The Spectrum passed me by as did the QL, the Acorn, the Enterprise (with the gestation period of an elephant) I congratulated my cynicism when I saw the mess the QL got into, (they only had to ask and I would have told them beforehand).

The CPC 664 arrived, oh no, could I resist...just, I bit the bullet and watied. The CPC 6128 arrived and I knew this was the one I had saved myself for all those years. It was everything I wanted and more. I couldn't believe the price, the speed of the Basic, the manual....the everything. On top of this when I had a slight problem with running a program designed for the 464 — not a software compatability problem but due to a rearranged keyboard configuration on the 6128 — I phoned up Amsoft, and got through first time, they put me on to Cliff Lawson one of their boffins.

He said "Oh yes there *is* a problem, I'll sort it out tonight at home and phone you with the solution tommorrow". And guess what....HE DID!

Steve Williams,
Twikenham,
Middlesex.

COMPUTER MAGIC-THE FACTS



I would like to set the record straight, with reference to an article on page 20 of the November issue of YC.

First, I would like it known that I am not in competition with the Magic Circle and/or with other members of the magic fraternity — of which I am a member — concerning "Computer Magic". Though it is true that is known that I am an exponent of this form of entertainment.

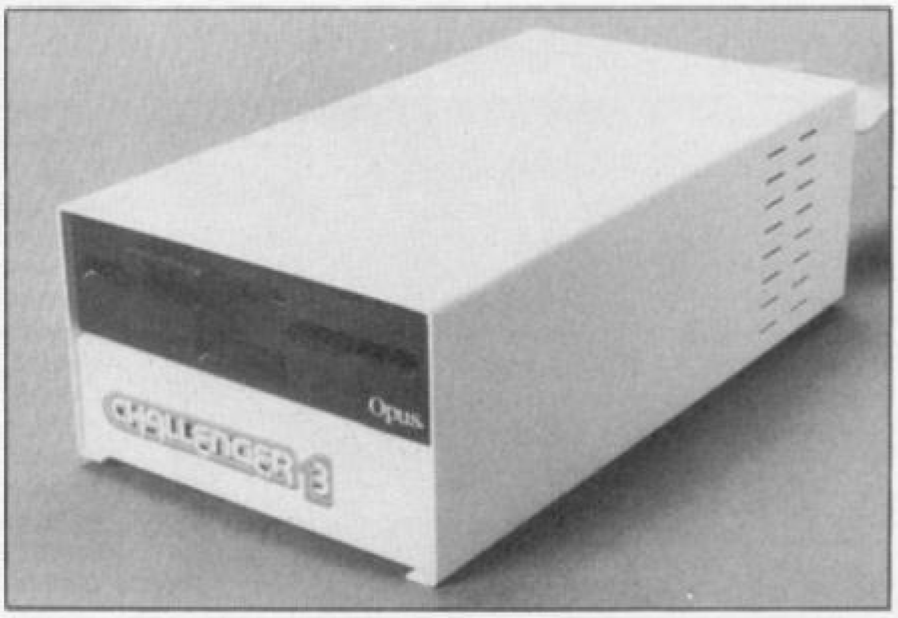
I would also like to point out that the name Sardi's is not a software house. In fact it is the name of my representatives as a professional entertainer, and have no links with the computer magic aspect as was reported in *Your Computer*.

The article in question, seems to have been written without all the facts, that were an offer to the publishers. I feel strongley that it was also detrimental in any respects to both Sardi's and myself.

David Hambly,
Redbridge,
Essex

CHALLENGER

▶Opus • Disc drive • BBC • £249.95



• Challenger disc drive from Opus

A Ram disc is a popular facility in disc operating systems. This unit takes the process a stage further by giving you 256 Ram contained within the drive unit which is configured as an extra disc drive. For an extra £70 you can have a further 256K Ram disc.

You also get Opus's highly regarded DDOS. This features single and double density storage, a host of extra commands, an expanded directory arranged as a series of volumes, and it doesn't tie up any system Ram (page is set at &E00).

The most startling use of a Ram disc this size is in programs which use random access files during the execution of a program. A prime example of this is Viewstore, a new data base from Acornsoft. Using Challenger, you will not notice the program updating the disc contents. Then when you've finished, you simply backup the Ram disc to the floppy disc and turn off.

Another application is for displaying large amounts of graphic data. The pictures can be pulled off disc virtually instantly. In strict performance terms, use of the Ram disc is around 20 times faster than most floppies.

Perhaps the only cloud on the horizon is software compatiability. Some protected programs won't load using Challenger. Challenger is available from computer dealers or direct from Opus on Redhill 65080.

HS-S1

▶Amstrad • Serial Interface • Honeysoft Ltd. • £29.95

• Honeysoft's serial interface, the HS-S1

Honeysoft is a small company specialising in Amstrad add-ons. Its serial interface allows the Amstrad to be connected with serial printers or modems.

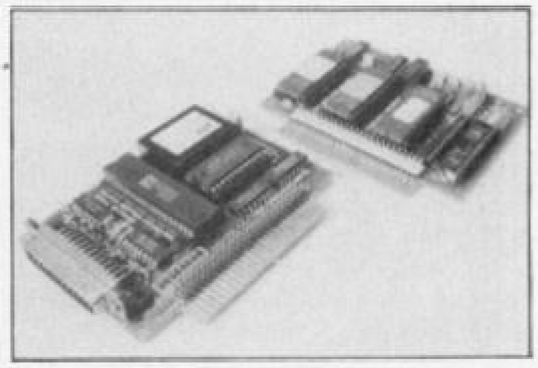
Two channels are supported over the usual range of baud rates. Word length and parity can also be set. One of the channels can use split baud rates and hardware handshaking, the other uses purely on/off protocols. The board is compact and well made with a full 25 way connector and an extension socket for further add-ons.

You can control the board under CP/M or by using Basic commands available on Rom, disc or cassette.

Honeysoft intend to support this board with Viewdata and Bulletin board software. Only preview copies were available with the review sample, but hopefully the final version should be available later this month. The pre-release version was easy to use, with most commands being accessed by menus overlaid on the page currently displayed. Two screen modes are available, mode 0 uses all eight colours, but the text is rather compressed, but still legible. Mode 1 has the normal character set, but the colours have to be fudged by stipling.

Other facilities planned will be familiar to Commstar owners, with pages held in memory, screen dumps of either text or graphics, saving and loading pages, tagging pages and clock. The system will be compatible with the new Micronet downloading service.

Again this software will be available on Rom, disc or cassette for around £20. It is



hoped that future upgrades will include colour screen dumps and off-line mailbox editing. If all that is promised is delivered, then this looks like a very promising product indeed. The serial board is also compatible with Amstrad's own interface.

The prices quoted for the Arnor products in last month's issue were incorrect. The Rom card is £15.95. Utopia is £29.95 and Protext is £39.95 on Rom. These programs are also available on disc and cassette.

LTR-1

▶Spectrum • Printer • Saga Systems • £149.90

Printers at this end of the market are generally thermal printers using expensive paper, or rather nasty dot matrix jobs. This product represents a notable first giving real letter quality. printing for under £200.

It takes plain A4 paper (but won't take continuous forms). The head consists of five character wheels spinning past the paper. The noise level is about the same as a daisy wheel, with bi-directional printing giving a print speed of around 10 cps.

The printer has a standard Centronics interface, and can also accept serial data through unused pins on the parallel port.

Christmas

Simon Beesley looks a cheaper buy for Christmas.



From the top: Memotch 500; Atari 800XL; Enterprise; JVC MSX; Spectrum +. Opposite: Canon V-20 MSX; BBC Electron.

Computer prices fall every year but this Christmas brings some really outstanding bargains. In some cases home computers are being sold for a half or even a third of their original price. For example, in January 1984 the Atari 800XL cost around £250. On top of this you needed to fork out £50 for an Atari cassette recorder. Now you can buy the machine for £100 with a cassette recorder, joystick and 10 programs thrown in for good measure.

£100, in fact, will buy you a micro with 64K Ram, colour, 3 channel sound, and a graphics resolution of at least 256 by 192. To put this price in perspective consider that in 1981 the 16K ZX81 — a machine with a bald keyboard and chunky black and white graphics — was rated a bargain at £120.

All the micros listed cost less than £180. Where the machine is sold in a package which includes a cassette recorder and joystick, the all-in price has been given. Usually it is substantially cheaper, than buying each item seperately.

Computers in this price bracket are suitable for the first-time buyer who wants to use a computer mainly for recreation. If you have a more serious application in mind you would do better to look at the micros covered in last month's guide. It is certainly possible to use a Spectrum for wordprocessing or keeping your accounts; but to do this you need to add a printer and a disc drive, along with appropriate interfaces.

Deciding which computer to buy partly depends on what you intend to do with it. People tend to justify their purchase by telling themselves that they will learn to program or that it will be useful for Junior's education. A few months later nine out of ten owners use their computer solely for playing games on. Fair enough, but it is unfortunate if there is not much software available for your machine. It may be a commonplace to say that a computer is only as good as the software that runs on it, but it is worth repeating nonetheless.

If you are interested in programming, a good keyboard and a fast, extensive version of Basic are features to look out for. Even programmers, though, need commercial software in the form of programming utlities, assemblers or other languages. So the question of software availability is important here, too.

The specifications of the 11 machines under £180 are given in the table. There is also a brief comment on each micro, which summarises its pros and cons. We have not thought it necessary to provide a list of peripherals. Printers, disc drives, modems, light pens, speech units, and other add-ons, are available for most of these machines.

Atari 800XL: Possibly the best value of all, for its robust keyboard, superior graphics, and high quality games software. Not as many news titles are released for the Atari as for the CBM-64 or Spectrum. But since it is compatible with earlier models there is a large range of programs already available.

Atari 130XE: More memory for your money than any other micro in this price range. Memory aside, it is almost the same as the 800XL with which it is software compatible. And as the processor can only handle 64K at a time the extra memory is only a minor improvement. It is unlikey that much commercial software will take advantage of it.

Commodore 16: Why Commodore chose to introduce a new micro which could not run CBM-64 software is a total mystery. Now superseded by the CBM 128, the CBM-16 will soon sink into oblivion.,

Commodore 64: Top of the table as far as games software is concerned. Only the Spectrum can boast as many titles, but the CBM-64's superb sound chip and superior graphics give it the edge quality-wise. Let down by a poor version of Basic.

Commodore Plus 4: Usefully includes four business programs, themselves not really

buys

powerful enough to make the Plus 4 a practical proposition as a business micro. It has received almost no support from third party manufacturers and software houses — and as a games machine it is a non-starter.

Electron: A crippled version of the BBC micro, the Electron suffers from insufficient memory and a shortage of ports. Its major asset is BBC Basic, although it is too slow to run most BBC software.

Enterprise: Although technically superior, the Enterprise was lauched too late in the day to have much success. Limited software.

Spectrum: Tacky keyboard, poor construction, and feeble sound facility. Yet the Spectrum's popularity has ensured that a massive amount of software has been written for it. A good machine to get started on.

Memotech: Both the 500 and 512 are well made machines with remakably high specifications for their price. Unfortunately they have not had the success they deserve, and as a result only a limited amount of software is available. Adding a disc drive to the 512 solves the problem by allowing you to run CP/M software, although most of it for business users only. If you are not interested in games the Memotech is one to consider.

MSX: Cannon, Toshiba, JVC, Sony, Mitsubishi, Yamaha, Spectravideo, in Rom, but the programs Goldstar, Sanyo and Panasonic, all make computers that conform to the MSX standard. The idea behind it is that by building computers to the same specification they can all run the same software. Too bad that the specification settled for was rather a dull one.





Cheap Micros

Machine	Price	Memory & processor	Graphics	Test	Colours	Sound	Ports	Keyboard	Software	Other Features
Atari 800XL	£9.99 inc joystick + cassette +	64K RAM 24K ROM 6502 1.8MHs	320×192 15 other modes	40×24 20×24 20×12	16 5 5	4 voices envelopes	Joystick, Serial, expansion composite video	Full Travel 4 funcional keys	Large range of games, some business and educational	Sprites, Cartridge slot
Atari 130XE	£119.90	128K RAM 24K ROM 6502 1.8MHz	320×19 10 other modes	240×24 4 other modes	128	4 voices envelopes	Joystick, serial, expansion, compsite video	Full travel 5 function keys	Runs 800XL software	Sprites
Commodore 16	£69.99 inc cassette + 4 programs	16K RAM 16K ROM 7501 1MHz	320×200	40×25	16	2 voices	Joystick, serial, expansion, user, composite video	Full travel 4 function keys	Very little not compatible with CBM-64	
Commodore 64	£199.99 inc cassette	64K RAM 16K ROM 6510 1MHz	320×200	40×25	16	4 voices envelopes	Joystick, Serial, expansion, user, composite video	Full travel 4 function keys	vast range, mainly games	Sprites
Commodre Plus 4	£99.99 inc cassette +	64K RAm 48K ROM	3200×200	40×25	16	2	Joystic, serial, expansion, user,	Full travel 4 function keys to improve	Not much at present, unlikely spreadsheet	Built-in wordprocessor, database and graph programs
Electron	£99.99 inc cassette + 5 programs	32K RAM 32K ROM 6502 2MHz	640×256 32×256 160×256	80×32 40×32 20×32	1 4 16	1 voice envelopes	Expansion	Full travel	Games and educational	Built-in assembler
Enterprise 64	£180	64K RAM 96K ROM Z80A 4MHz	675×512 3 other modes	84×56 40×24	2 up to 256	4 voices envelopes stereo	Expansion, RS232 Centronics, Joystick, RGB	Membrane type 16 function keys	Not much, may improve	Built-in wordprocessor, stereo output
Memotech 500	£79	48K RAM 24K ROM Z80A 4MHz	256×192	40×24	16	4 voices envelopes	Centronics, RS232 joystick, RGB expansion	Full travel 8 function keys numeric keypad	Some games and business	Built-in assembler, assembler, Logo, Noddy
Memotech 512	£130	80K RAM 24K ROM Z80A 4Mhz	256×192	40×24	16	4 voices envelopes	Centronics, RS232 joystick, expansion	Full travel 8 function keys, numeric key pad	Some games, business, and CP/M option	Built-in assembler, Noddy, Logo
MSX	£99.99 upwards	64K RAM 32K RAM Z80A 4MHz	256×192	40×24	16	3 voices	Centronics joysticks	Full travel 10 function keys	Not a great deal at present may improve	Cartridge slot
Spectrum Plus	£139.99 inc Joystick + cassette + 10 programs	48K RAM 16K RAM Z80 3.5MHz	256×176	32×24	8	Beep				

The charts

TOP 30 OVERALL CHART

1	MONTY ON THE RUN	GREMLIN GRAPHICS
2	WAY OF THE EXPLODING FIST	MELBOURNE HOUSE
3	FRANK BRUNO'S BOXING	ELITE
4	IMPOSSIBLE MISSION	EPYX/US GOLD
5	FORMULA ONE SIMULATOR	MASTERTRONIC
6	FINDERS KEEPERS	MASTERTRONIC
7	DALEY THOMPSONS SUPER TEST	OCEAN
8	ACTION BIKER	MASTERTRONIC
9	STARQUAKE	BUBBLE BUS
10	HACKER	ACTIVISION
11	FIGHTING WARRIOR	MELBOURNE HOUSE
12	BMX RACERS	MASTERTRONIC
13	WHO DARES WINS 2	ALLIGATA
14	GRAHAM GOOCH TEST CRICKET	AUDIOGENIC
15	FAIRLIGHT	THE EDGE
16	CHILLER	MASTERTRONIC
17	BEACH HEAD	ACCESS/US GOLD
18	BORED OF THE RINGS	SILVERSOFT
19	NONTERRAQUEOUS	MASTERTRONIC
20	WORLD SERIES BASKETBALL	IMAGINE
21	NOW GAMES	VIRGIN
22	MATCH DAY	OCEAN
23	HYPERSPORTS	IMAGINE
24	VEGAS JACKPOT	MASTERTONIC
25	SUMMER GAMES 2	EPYX/US GOLD
26	PARADROID	HEWSON CONSULTANTS
27	ELITE	FIREBIRD
28	SHADOW OF THE UNICORN	MIKROGEN
29	KIK START	MASTERTRONIC
30	SPY VS SPY 2	BEYOND

TOP 10 BUBBLERS

1	WINTER GAMES	
2	SUPER ZAXXON	U.S. GOLD
3	QUEST FOR THE HOLY GRAIL	MASTERTRONIC
4	COMPUTER HITS (10)	BEAU JOLLY
5	SPIKE	FIREBIRD
6	RAID!!	US GOLD
7	ASTRO CLONE	HEWSON CONSULTANTS
8	SOUL OF A ROBOT	MASTERTRONIC
9	STRIKE FORCE HARRIER	MIRRORSOFT
10	ONE MAN AND HIS DROID	MASTERTRONIC

SPECTRUM SALES

THIS	LAST	WKS	TITLE	PUBLISHER
01	NE	01	MONTY ON THE RUN	GREMLIN GRAPHICS
02	01	02	IMPOSSIBLE MISSION	US GOLD
03	02	10	WAY OF THE EXPLODING FIST	MELBOURNE HOUSE
04	03	07	DALEY THOMPSON'S SUPER TEST	OCEAN
05	NE	01	STARQUAKE	BUBBLE BUS
06	04	05	FIGHTING WARRIOR	MELBOURNE HOUSE
07	06	07	FAIRLIGHT	THE EDGE
08	08	03	GRAHAM GOOCH TEST CRICKET	AUDIOGENIC
09	NE	01	WORLD SERIES BASKET BALL	IMAGINE
10	RE	05	ACTION BIKER	MASTERTRONIC

COMMODORE SALES

THIS	LAST	WKS	TITLE	PUBLISHER
01	NE	01	MONTY ON THE RUN	GREMLIN GRAPHICS
02	01	02	WHO DARES WINS 2	ALLIGATA
03	02	10	SUMMER GAMES 2	EPYX/US GOLD
04	06	02	PARADROID	HEWSON CONSULTANTS
05	04	06	FRANK BRUNOS BOXING	ELITE
06	05	11	WAY OF THE EXPLODING FIST	MELBOURNE HOUSE
07	RE	05	KIK START	MASTERTRONIC
08	03	05	SPY VS SPY 2	BEYOND
09	09	08	BARRY MCGUIGAN WORLD CHAMPIONS	ACTIVISION
10	RE	10	BEACH HEAD 2	ACCESS/US GOLD

AMSTRAD SALES

THIS	LAST	WKS	TITLE	PUBLISHER
01	04	10	FINDERS KEEPERS	MASTERTRONIC
02	NE	01	RAID!!	US GOLD
03	10	10	FRANK BRUNOS BOXING	ELITE
04	08	02	SOUL OF A ROBOT	MASTERTRONIC
05	02	11	WAY OF THE EXPLODING FIST	MELBOURNE HOUSE
06	07	11	NONTERRAQUEOUS	MASTERTRONIC
07	01	02	FORMULA ONE SIMULATOR	MASTERTRONIC
08	03	03	GRAND PRIX 3D	SOFTWARE INVASION
09	09	11	CHILLER	MASTERTRONIC
10	06	08	LOCOMOTION	MASTERTRONIC

FAIRLIGHT

▶ *Spectrum • The Edge • Arcade adventure • £9.95 • Toby Wolpe*

VALUE FOR MONEY
●●●●
GRAPHICS
●●●●●
PLAYABILITY
●●●●
SOUND
●
OVERALL RATING
●●●●



In the mythical kingdom of Covent Garden, once people by a fair race, a band of strolling software magicians, known to story-tellers as Ye Edge, conjured up a corny sub-Tolkein plot to accompany a truly wonderful arcade adventure — Fairlight.

But once you're inside the dubious-sounding Castle Avars you soon forget about background details like the land of Fairlight slipping into chaos and darkness. The graphics are excellent, better in some ways than Ultimate's latest offering Nightshade. The Edge put it down to "The 3-D Worldmaker Technique".

Whatever you want to call it, the result is good, smooth animation in two colours.

As with all the best games the idea behind it is simple. You, Isvar, must escape from the castle by finding The Book of Light. There's also the standard hooded old man of mystery who presumably gets out when you do.

The idea may be simple but escaping isn't. Collecting the right items is the only way of mapping out the castle's 80-odd ogres. Finding the objects isn't too bad — the early ones at least. The problems start when you have to work out what to do with them.

The scroll is the sorcerer's equivalent of an ejector seat; when the going gets tough it'll plonk you down in the relative safety of the courtyard. The bag of gold is handy for bribing certain guards, while food, keys and magic potion should all be fairly self-explanatory.

To reach certain objects like the egg timer requires a lot of shoving and stacking of furniture. Addicts of Ultimate's Knight Lore and Alien 8 will really feel at home.

The booklet with the game suggests that you examine the cover, opening screen and text for clues. To me the cover showed a wizard loosely resembling Edge boss Tim Langdell reading a radioactive *Your Computer* binder. The opening screen did however give a few hints; it gives you an aerial view of part of the castle, for example.

Apart from its graphics and complexity, it's touches like Isvar's five pocket and the weight restrictions on what you can carry that make this such a good game. Should keep you happily gnashing your teeth for hours.

SCREENS

• When the going gets tough in Fairlight a scroll will help you get going again.

3D GRAND PRIX

▶ *Any Amstrad • Amsoft • Racing Game • £9.95 • Lee Paddon*

VALUE FOR MONEY
●●●
GRAPHICS
●●●
PLAYABILITY
●●●●
SOUND
●●●
OVERALL RATING
●●●



Well, if Nigel Mansell can win a Grand Prix, I suppose anything's possible. So perhaps a few laps of this might show you if you've got what it takes.

You get a cockpit view of the track ahead, with rev counter, speedo, temperature gauge and wing mirrors. You get eight circuits to tackle in turn. You have to finish in the top three of one race to proceed to the next. The opposition starts easy and gets tougher as you go on.

The car has four gears, accelerator, steering and brakes. The steering is of the usual digital variety, and rate of turning depends on speed. If you corner too sharply, you spin off. The usual Pole Position tactic of overtaking on the grass gets you nowhere fast, and the other cars have a nasty habit of blocking you. The temperature gauge limits the amount of time you can go at full pelt, overheating produces a dramatic loss of speed.

As far as a simulation of a race goes, this one slots in somewhere between Pole Position and Taledega, but that said, it is easily the best racing simulation for the Amstrad.

SCREENS

• Clear cockpit display with Revs style wing mirror.

SOFTWARE SHORTLIST

HACKER

▶CBM-64 • Activision • Hacking • £8.95 • Lee Padon

VALUE FOR MONEY ●●●
GRAPHICS ●●●
PLAYABILITY ●●●
SOUND ●●

Possibly about the worst thing you can do if you want to play this game is read a review of it. After loading up, you are left with the enigmatic message "Logon:", and that's it. No instructions, no hints, no nothing. Thus, if you read a review, you will end up knowing more about the game than was intended, and discovery is half the fun.



SCREENS
• The grid represents a network of secret tunnels linking cities around the world.

What it boils down to is trudging around the world in your little gismo — or SRU if you prefer — negotiating with spies, piecing together documents and acquiring information about the network you have penetrated.

Is it a simulation of hacking? Well, yes, in as much as that is possible. It is the same combination of logic, inspired guesswork and lucky breaks. Is it fun? After all, one of the main motivations for hacking is you are doing something illegal, you don't get the same thrill with Hacker. Still, there are enough problems to solve in what might be termed an electronic adventure game to keep most would-be hackers happy and it'll keep the phone bill down.

OVERALL RATING ●●●

CRUSADE IN EUROPE

▶CBM-64 • Wargame • US Gold • £23 • Lee Paddon

VALUE FOR MONEY ●●●●
GRAPHICS ●●●●
PLAYABILITY ●●●●
SOUND ●●●

"All very clever, but it's not really a simulation," has until now been the stock response of tabletop wargame enthusiasts to the computerised variety. However, this game is going to set a new standard, with an outstanding combination of realism and playability.

The game simulates the campaign in North-West Europe, from the D Day landings to the Battle of the Bulge. This can either be done in a series of scenarios tackling the major battles, or as a continuous campaign covering the four months to the beginning of October. The screen shows the units involved in the battle, the terrain, any enemy units you are in contact with, a text window for messages, and a cursor for entering commands.

To enter a command, you place the cursor over the unit, and press fire. This gives a detailed picture of the unit's current status, its strength, deployment, combat readiness and supply state. You can then proceed to give it orders. There are no separate phases for giving orders, it is all real time, you just give the orders and the units get on with it. Supply considerations take two forms, individual supply, where a check is made every day to determine whether the unit can be supplied, and overall supply, where the amount of supply used is calculated and compared



SCREENS
• Like Eastern Front Crusade's display changes colour depending on the season.

with the amount of supply flowing in. This can restrict the amount of activity possible. All this detail gives a great feel of overall command. You give the orders while remaining unencumbered bys the detail, free to keep a strategic view of the whole situation.

The game can either be played against the computer, or a human opponent. It can be weighted to one side or the other, and, at the end, the computer assesses the

DECISION IN THE DESERT

▶CBM-64 • US Gold • Wargame • £19.95 • Lee Paddon.

VALUE FOR MONEY ●●●●
GRAPHICS ●●●●
PLAYABILITY ●●●●
SOUND ●●●

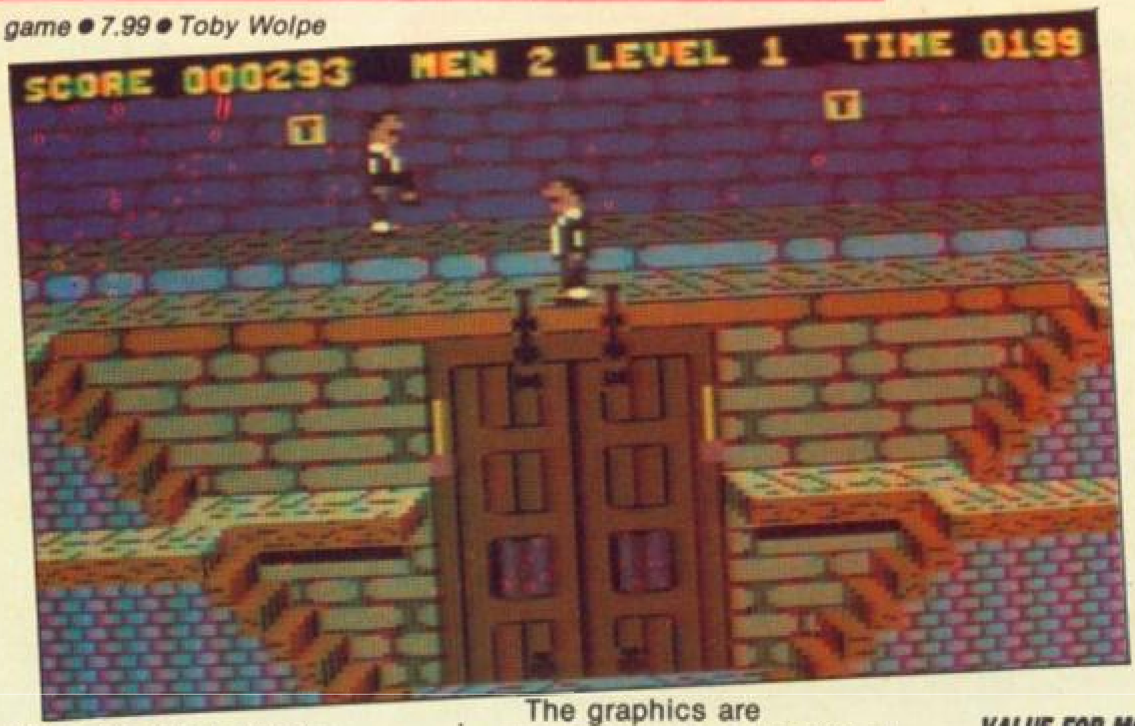
The sequel to Crusade in Europe, this features five scenarios covering the major battles in the Western Desert from Sidi Barrini to El Alamein. The system copes surprisingly well with the complex battles.

Microprose claims it is off to the jungles of Indo China for the next in the series, presumably to cater to the market of Vets eager to refight the war to see what effect nuking Ho Chi Minh City would have had.

OVERALL RATING ●●●●●

SCHIZOFRENIA

▶CBM-64 • Quicksilva • Platform game • 7.99 • Toby Wolpe



This game rates as high in paranoia as it does in frustration. Why is Quicksilva out to persecute me by making it so difficult to play?

Everything you do in screen 1 of this five-screen game is quickly undone by the evil side of Alphonse T Nurd — the other half of your personality. You, the good Alphonse, are a lab cleaner. But instead of just dusting the Atomic Particle Separator, you apparently tried it out on yourself — with personality-splitting results.

The only way of becoming whole again is to make it as far as screen 5 and the Recombination Chamber.

Forgetting the frustration factor for a minute, Schizofrenia has several good original features, like the fact you have to flick two switches on the first screen to stop the timer and start the score clock running.

The score has to be greater than the time you've taken to rack up any points. You score by drawing the four bolts on the great doors that lead to the next chamber. The catch is that your alter-ego is busy flicking the switches back again and sliding the bolts shut.

To get through the lifts and yellow boxes of screen 2 you have to follow Alphonse II around area 1, flicking switches and pulling bolts and then making a rush to the right-hand lever to open the doors.

The graphics are reasonable with a traditional platform game side-on view of the action. But the animation isn't wonderful. The characters prance around the screen like demented Morris men. Even if you're walking along a flat platform, the movement's the same as walking up stairs.

A good, original approach to mental illness which should drive you mad even if you weren't to start with. But I'm in two minds whether to recommend Schizofrenia as a great game.

OVERALL RATING
●●●

VALUE FOR MONEY
●●●
GRAPHICS
●●●
PLAYABILITY
●●●
SOUND
●●

SCREENS
• Don't be fooled by the kilsch look of the product Schizophrenia is really kafhaesque.



overall performance of the players. It may be a steep price, but then you get a lot of game for your money, which should keep the enthusiast happy for a long time, and reflects the amount of care and historical research that has gone into this. Once again, Microprose have produced a great product with lasting appeal.

OVERALL RATING
●●●●●

WHAM — THE JUKE BOX

▶ZX Spectrum • Melbourne House • Music utility • £9.95 • Tony Sacks

There used to be one inviolable certainty to cling to in these changing times — the immutable fact that the Spectrum has just one sound channel. But now even this sacrosanct truth has been rudely, and noisily, shattered by this devilish bit of software which gives the Spectrum two sound channels using the original hardware.

Wham — no connection with the George/Ridley duo, you may be relieved to hear — allows you to compose separate bass and melody lines over a four-octave range and even to include vaguely drum-like effects (but not simultaneously with the notes). Notes are entered and displayed on musical staff and, as they are being played, the notes are depicted by dots bouncing around on a piano keyboard.

The hideously named Whampiler allows you to use the tunes you compose to enliven your own programs. The compiled music takes up less than 1K of memory, no matter how complex it is.

One snag is that all the notes have to be the same length, although rests can be inserted between notes and the tempo of a piece can be varied.

W-TJB will probably appeal most to programmers wanting to add music to their graphic masterpieces; as a stand-alone music-making package its staying power is questionable.

OVERALL RATING
●●●

GRAPHICS
●●
SOUND
●●●●
PLAYABILITY
●●●
VALUE FOR MONEY
●●●●

BATTLE OF BRITAIN

▶Amstrad ● PSS ● Wargame ● £9.95 ● Lee Paddon



GRAPHICS ●●●
SOUND ●●
PLAYABILITY ●●●●
VALUE FOR MONEY ●●●●

SCREENS

● Battle of Britain — phew against the many Hunnish hordes.

In this, the latest in PSS's wargame series, you take the part of 11 group controller, directing "The Few" against the Hunnish hordes. The display shows the position of incoming raids, any squadrons you have scrambled, as well as the position of airfields, radar stations and towns in south-east England.

You must attempt to repel the Luftwaffe raids while maintaining the RAF in fairly good nick. In the air, you can be sure of a loss rate of about five to one, but the risk is getting caught on the ground whilst refuelling, which will lose you half the aircraft on the field. This leaves the player with a nice dilema of how many squadrons to commit to dealing with each raid.

As is obligatory with this PSS series, you can have arcade sequences where you fight one of the battles, as usual you are not entirely sure what you are doing and it is best to ignore it. There are three scenarios: introductory game, Blitzkreig, and campaign game. The campaign game broadly follows the pattern of the German campaign, with initial raids on the radar system, followed up by attacks on the airfields.

At the end of each day you get a number of replacements to make your squadrons up to strength.

Definitely the best offering yet in this series, with lots of historical flavour and attention to detail.

OVERALL RATING ●●●

SATELLITE WARRIOR

▶Amstrad ● Amsoft ● Trading Game ● £7.95 ● Lee Paddon

GRAPHICS ●●●
SOUND ●●
PLAYABILITY ●●●●
VALUE ●●●

Coming close on the heals of adventure games and Star Trek, Hamurabi and its variants has a long and distinguished history; this game represents a new variation on the familiar theme.

You play either against the computer or another player, the idea is to colonise the solar system with satellites and exploit its economic resources, and thus build more satellites and so on. You are also visited by aliens who can trade you items which you don't produce, there is no direct trading between the players. Regretably, when two players attempt to exploit the same planet, the satellites must duel to the death.

There are three varieties of weapon for use at different ranges, and three types of defence.

The game's overall tone is light hearted, with jolly bug eyed monsters and defeated satellites falling to bits like an MoT failure in the fast lane. Victory is all about getting the bits you need to make really nasty satellites.

OVERALL RATING ●●●

SOFTWARE SHORTLIST

CODENAME MAT II

▶Spectrum and CBM-64 ● Domark ● Shoot-em-up ● £8.95 ● Lee Paddon

VALUE FOR MONEY
●●●
GRAPHICS
●●
PLAYABILITY
●●
SOUND
●●●

After the cult status bestowed on the original, this sequel has been eagerly awaited. This time, your old adversaries, the Myons, are bent on destroying a bunch of satellites. You have to protect them by destroying wave after wave of Myons before they have time to wreak havoc.

Between waves, you get a chance to repair either the ship or some satellites. Your ship also has two droids which can make running repairs in combat. The instrumentation is complex with scanners, battle computers, status indicators and so on. Combat consists of warping towards the enemy sector, and then once there, you close in on them using your scanners, and then do a spot of dogfighting.

Damage occurs when you take hits, or collide with the enemy. There are numerous systems all over the ship; damage affects the operation of the ship to a varying extent, and you must decide what gets priority for repair.

Despite all this fairly complex stuff, the guts of the game is shooting Myons and a pretty uninspiring bunch they are too. They come in a variety of shapes and sizes, some with cloaking devices. But really, these days we expect our aliens to be three-dimensional and have a bit more grey matter. This game is in many ways a step backward from the original. Brewster fans were expecting a lot more.



SCREENS

● Codename MAT II. Myons aren't what they used to be.

OVERALL RATING
●●●

STRIKE FORCE HARRIER

▶BBC B and Electron ● Mirrorsoft ● Flight Simulator ● £9.95 ● Lee Paddon

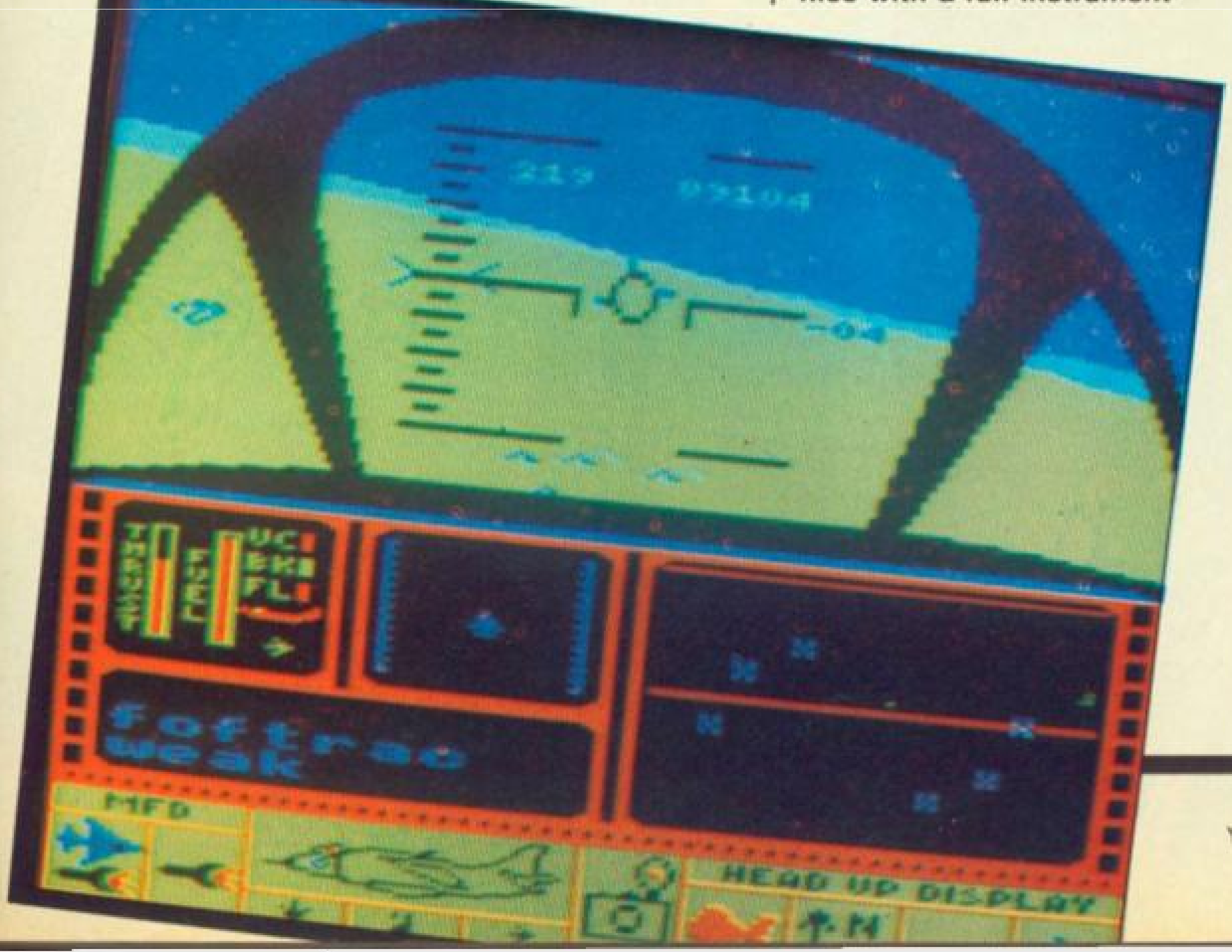
GRAPHICS
●●●
SOUND
●●
PLAYABILITY
●●●
VALUE FOR MONEY
●●●

SCREENS

● Head-up display, target computer and air attack radar in Strike Force Harrier.

Still playing Aviator? Well at last Mirrorsoft have come to the rescue of Beeb owners still dementedly flying under bridges and shooting space invaders with their Spitfire.

This will take a bit of getting used to for the seat-of-the-pants crowd. The 'plane actually tries to help you to fly it with useful little warnings like "you are about to hit the ground" and "someone is shooting at you". Unfortunately, most of these warnings are accompanied by some of the most ear splitting sound effects witnessed in this office for some time. Definitely one to get the neighbours hammering on the wall during late night sorties. The avionics are very nice with a full instrument panel, Head-Up Display, target computer and air attack radar.



Unfortunately, there is a price to be paid with rather dismal graphics in the way of ground detail and enemy aircraft. The scenario is rather bizarre. You have to destroy an enemy base. In order to do so, you must move through enemy territory knocking out tanks, SAM batteries and aircraft. Having prepared the ground, you land and call up your ground staff to repair and refuel your aircraft.

This you repeat as often as necessary to reach the base. The most exciting feature is the "Viff", or vectored thrust, which is faithfully reproduced. This is not only handy for vertical takeoff and landing, it is also comes in useful in aircombat. Another nice feature is doing high-G turns on the higher levels will cause black-outs (instruments not recommended). All in all, one the flying addicts will want to add to their collection.

OVERALL RATING
●●●●

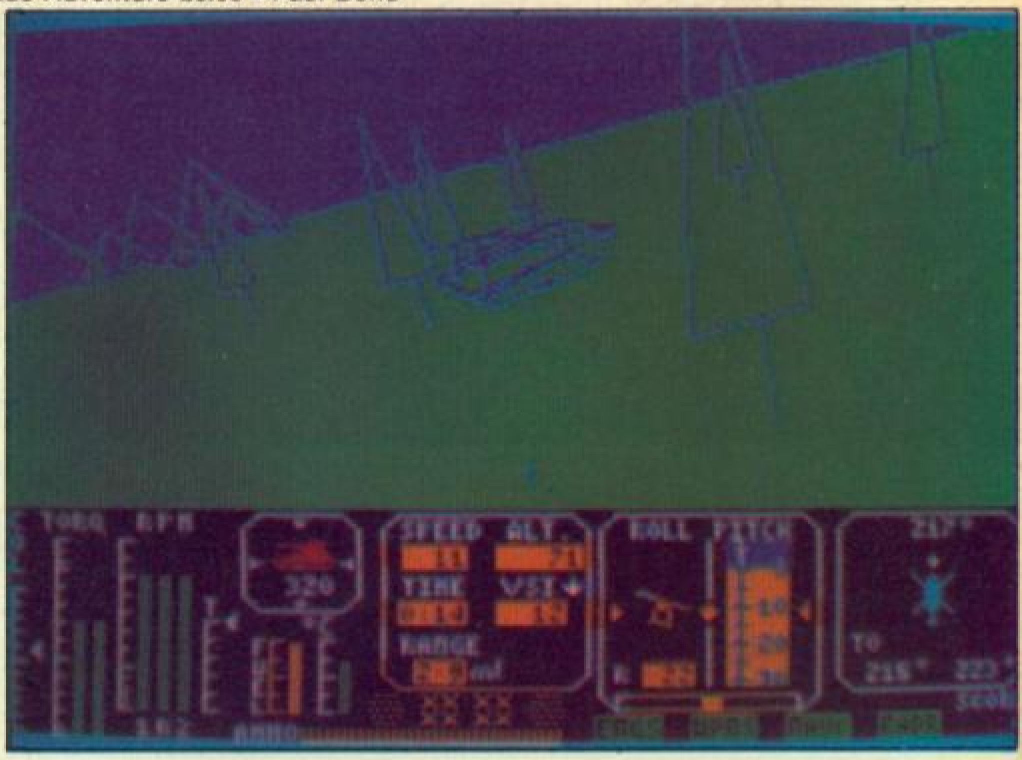

ocean
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TOMAHAWK

▶Spectrum ● Digital Integration ● Arcade Adventure £9.95 ● Paul Bond

GRAPHICS
● ● ● ● ●
SOUND
● ●
PLAYABILITY
● ● ● ●
VALUE FOR MONEY
● ● ● ●
OVERALL RATING
● ● ● ●

SCREENS



● Tomahawk — Flight International likes it.



● Rigth: Dave Marshall, author of Tomahawk.

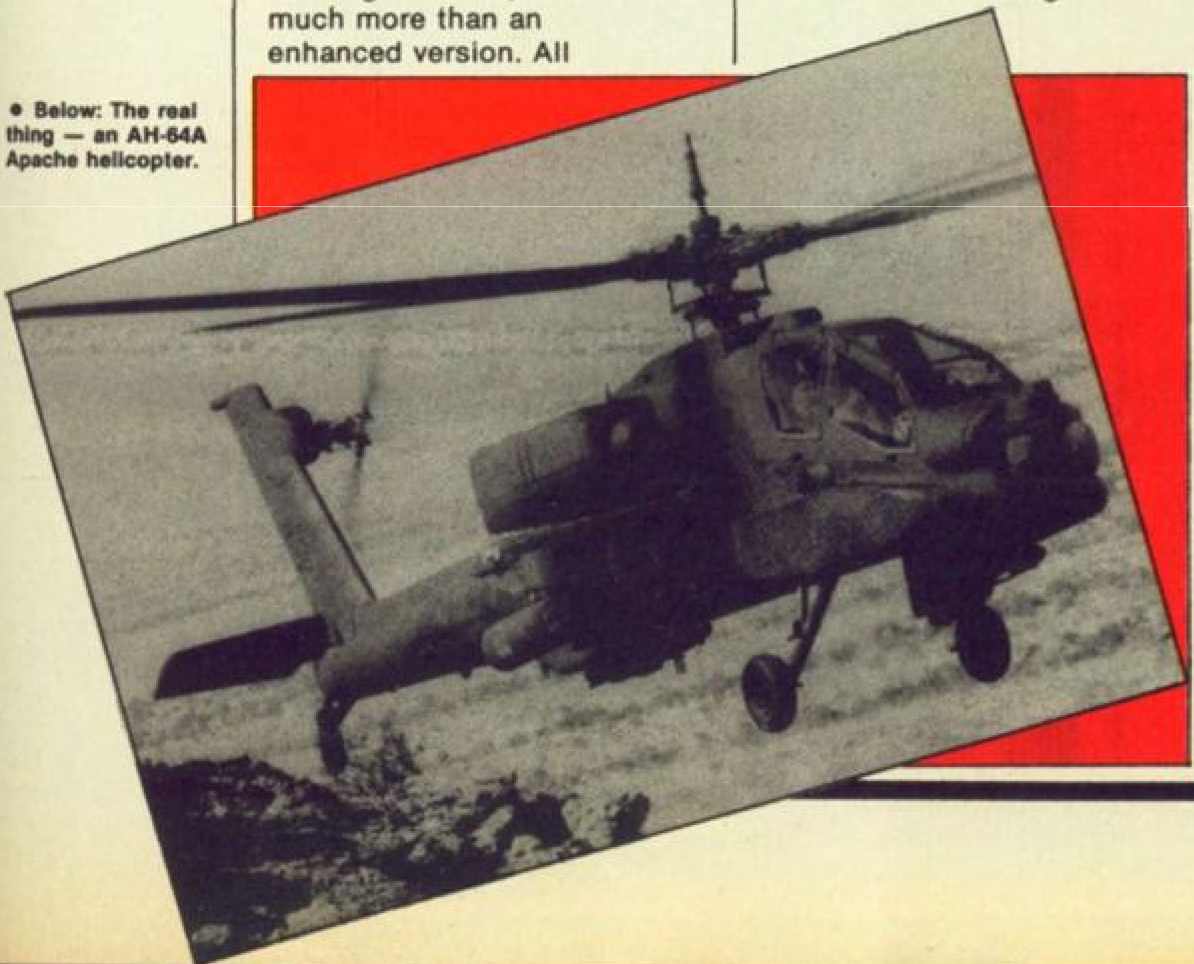
Over 7,000 ground features and some of the best wire-frame 3D graphics this side of Novagen's long-awaited Mercenary, Tomahawk puts you in control of the US Army's latest attack helicopter, the Apache. Promoted by Hughes as "an extension of the pilot's will', it's appropriate that the Spectrum simulation of such a hi-tech heli marks the commercial debut of the Lenslok protection system. This, of course, is a game in itself — hours of fun to be had squinting through a plastic lens at the VDU guessing at the combinations of any two letters of the alphabet.

Once past this hurdle, you can open the throttle, ease forward on the collective, and leave the pad. As the 3D world display unreels you will see landing pads, buildings, trees, transmission pylons, mountains, enemy tanks (moving and firing), field guns, and airborne enemy helicopters.

A number of mission scenarios are available to you: flying training or combat, with different difficulty levels, you can select a low cloudbase of a night mission. In this last you can try out the infra-red vision - same game but in red and black. The display will be familiar to afficionadoes of DI's Fighter Pilot, but is much more than an enhanced version. All helicopter characteristics are faithfully reproduced; slowing down is best achieved by use of the cyclic pitch controls rather than reducing throttle level — you tend to plummet — and you can fly sideways or backwards. Weapons include eight Hellfire missiles which automatically destroy anything in your sights plus 38 unguided rockets and a machine gun. The Target Acquisition and Designation System tells you whether your target is friend or foe — most modern military hardware has a built-in identification signal.

The system has been designed with Interface 2 in mind, so that it's possible to fly like a real helicopter pilot using one joystick for throttle control, the other for altitude control.

Much more accessible to the casual player than Fighter Pilot, what more can I say than that our fellow-journalists on Flight magazine have, over a cup of coffee, voted this one of their favourite games.



● Below: The real thing — an AH-64A Apache helicopter.



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Written by Roger & Bruce Carver • Directed by Bruce Carver • Produced by Chris J. Jones • Distributed by David L. Ashby
Illustration by Oliver Frey (Newsfield Publications) • Manufactured in the U.K. by U.S. Gold.

COLOSSUS CHESS 4.0

▶CBM-64 ● CDS Software house ● Chess ● £9.95, disc £14.95 ● Toby Wolpe

VALUE FOR MONEY ●●●●
GRAPHICS ●●
PLAYABILITY ●●●●
SOUND ●
OVERALL RATING ●●●●

SCREENS

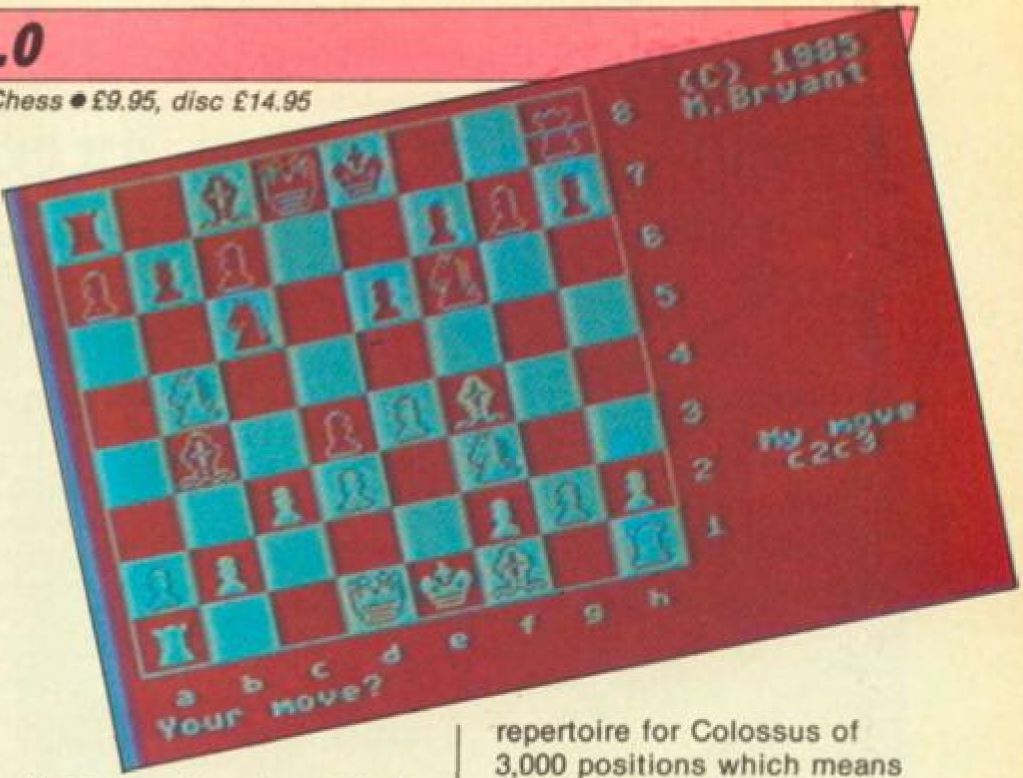
● Colossus Chess 4.0 — for the budding Kasparov.

With the scalps of major chess programs like Sargon, Superchess, Cyrus and White-Knight to its name, Colossus 4.0 has the power and quality of play to keep most amateurs busy for hours.

Add to that a comprehensive list of features ranging from elapsed-time clocks to blindfold chess and you're certainly getting your money's worth.

The chess diagram-like view of the board leaves no margin for confusion although in terms of graphics sophistication it's a long way behind Psion's spectacular 3D QL Chess. You pick you move by placing the cursor line over a piece and then on to its destination.

There's also a joystick option, or if you're happier working in algebraic E2-E4s then you can just bash them in directly from the keyboard. As in all the best chess programs you can also back-step through up to 120 moves using B, or forwards with F. A quick poke at the R key gives a full action replay.



You have six playing modes to choose from. They range from Tournament with its four time contols, through Average mode where you can pick the computer's response time, to the Equality, All-the-moves, Infinite and Problem modes. Colossus always starts off in Average mode unless you specify something else.

CDS claims an opening repertoire for Colossus of 3,000 positions which means if there is to be any agonising about the opening moves it's you who does it.

Colossus presents you with two screens. One is text only, and gives you details of the moves played so far together with the program's thoughts on possible lines of play and times. The second screen holds the graphical picture of the board. You can flick to and fro from one screen to another with a tap of the space-bar.

MARSPORT

▶Spectrum ● Gargoyle ● Arcade adventure ● Meirion Jones

VALUE FOR MONEY ●●●●●
GRAPHICS ●●●●
PLAYABILITY ●●●●
SOUND ●●
OVERALL RATING ●●●●

SCREENS

● Marsport — you'll feel like a ninepin in a skittles alley.

If you ever wanted to know what a ninepin feels like in a skittles alley then Marsport is the game for you. There you are doing the usual Dun Darach Tir Na Nog bit clomping around like Piltdown Man but this time in a space bubble on Mars rather than in some medieval marsh.

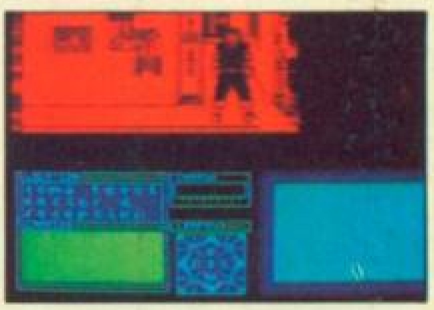
Every so often a bowl hurtles by at head height — but just for once in a computer game you don't have to duck, for these are harmless information gathering robots.

Previous Gargoyle games were a bit thin on plot, but Marsport is an intricate and well structured arcade adventure with much more going on. In the first stage of the game you — or rather Commander John Marsh of the underground Earth liberation movement Hasp — have to acquire a power weapon and fight your way through the 10 levels of the city trying to locate the central computer.

A series of hatches in the walls open as you walk by. These can be supply units for which you sometimes need a key which give you objects to use, lockers which you can stow your objects in — because you can only carry three at a time, bins, and charge units to keep your gun loaded.

You need the gun to deal with robots and Septs — the invading life-forms which Gargoyle politely calls a hive culture but which we all know is really just a swarm of intergalactic killer bees. But then I suppose the Septs would call Commander Marsh a terrorist (Geddit?).

The most fearsome adversary in the game is a Sept Warlord — which looks just like a Victorian vacuum



cleaner and is almost as dangerous.

The robots that occasionally attack you are malfunctioning warden robots installed by your own forces long ago. If only they belonged to the other side we could call them septic tanks. Once you have reached the computer you can start your search for the original plans for the giant force field which is all that stands between the Septs and Earth and now needs stengthening. Your final challenge is to escape with the plans.

CRITICAL MASS

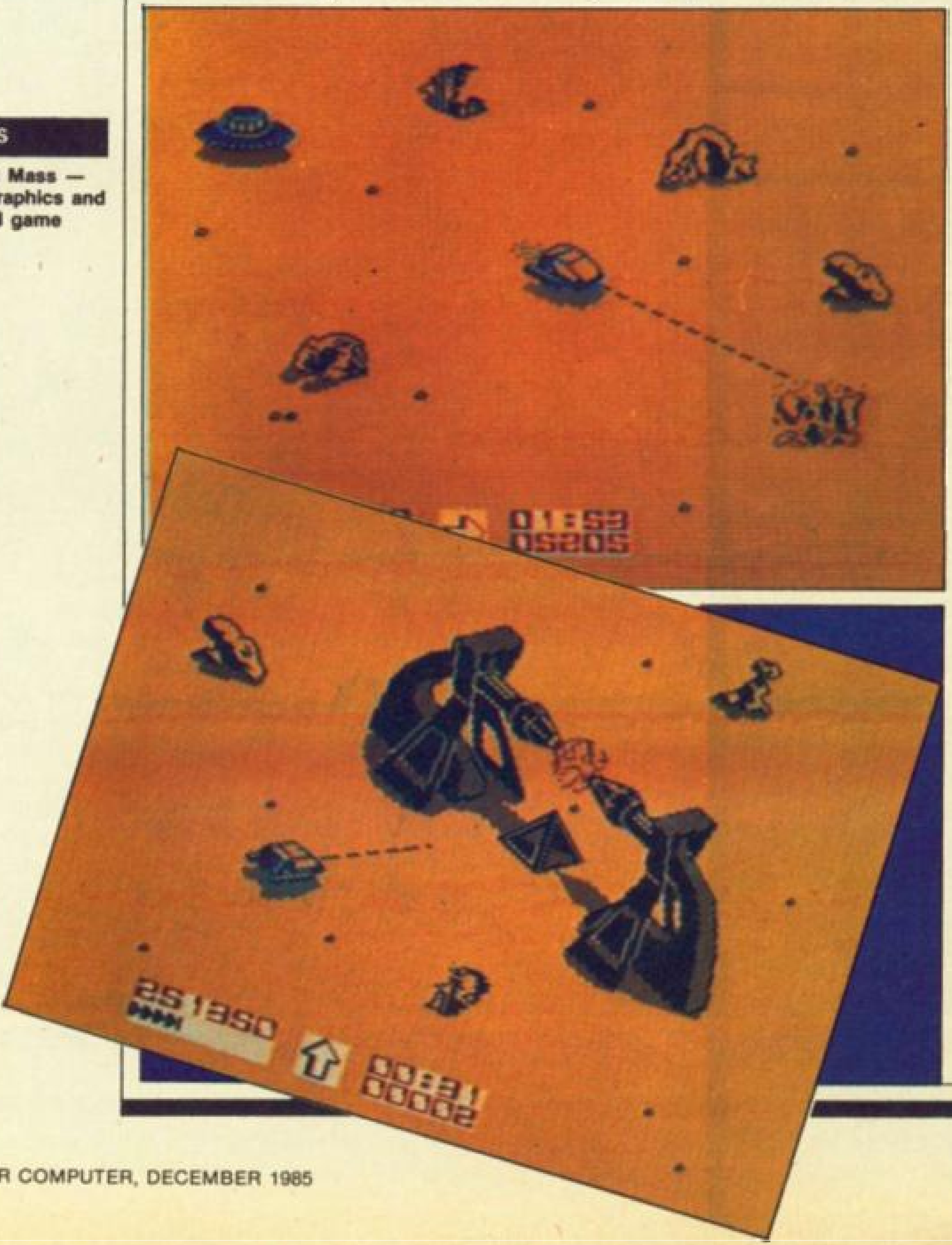
Spectrum ● Durell Software ● Arcade Safari ● £9.95 ● Paul Bond

VALUE FOR MONEY
●●●●
GRAPHICS
●●●●●
PLAYABILITY
●●●
SOUND
●●●
OVERALL RATING
●●●●

Trashed my strike craft in a rock outcrop — anybody knows what that means out here. As the wreckage bounced away from me I punched the button on my jet pack and got sky-side just as the sand-worm reared its ugly head a few feet from me. Back to the pressure-dome for a new ship — losing your no-claims bonus is bad enough but when aliens have infiltrated into your power-plant in a bid to make it meltdown the local star-system you don't worry so much about that kind of thing.

Brilliant graphics and an original enough game concept programmed by Simon Francis. Durell have a real winner here. The screen shows an aerial 3D view of a barren desert landscape, cheerful tunes play in the background (if you can hear them on your Spectrum). Fly your surface skimmer towards the right hand side of the screen. Try not to hit any rock outcrops or UFOs otherwise you spin off like a drunken dodgem driver. Too many smashes and your ship blows up — this effect is particularly good with all the bits bouncing all over the place. An arrow at the base of the screen indicated where the nearest pressure dome is. Get into the vicinity and you are sucked in.

The dome then bifurcates and releases you in your new skimmer. Paul Atreides would be at home on this planet since giant Dune-style sandworms rear their ugly heads and reduce your energy if you bump into them. Dull it isn't. You can shoot back at attacking vehicles although many of the phenomena which assault you are indestructible and very very persistent. A swarm of diamond-shaped objects is generally the finishing element for people trying to penetrate the outer wall of the power plant, where all the real fun with the enemy counter-attack vehicles begins. Excellent and also available for Commodore.



SCREENS

● Critical Mass — Brilliant graphics and an original game concept.



Simon Francis learned about commercial software the hard way. He wrote a couple of games for the Dragon 32, and his "friends" persuaded him to take his name out of the program. Due to the Dragon's later demise, he thought no more about it until he saw his program being marketed by a large budget software company at a *Your Computer* show. "I haven't been ripped off that much. If it had been for a really popular machine like the Spectrum or the 64 I would have lost thousands of pounds. Still, they're not my friends anymore."

There are a thousand stories like this in the software city, but this may have been a contributory factor in forcing Simon to wean himself off the 6809 processor. "I loathe the Z-80." This should give heart to hard-done-by Dragon owners everywhere. Fighting his revulsion with its CPU, Simon started the Spectrum game as a small window at the top left-hand-side of the screen, using interrupt mode 2 to print up all the characters, first in memory, then to the screen.

"When I expanded the screen up my memory dump was 6K — obviously any larger would be too much memory so I had to modify all my routines accordingly." The main core of the game is written using the latest techniques — "You can usually work out what's going on in the programming just by looking at the screen. I sometimes videorecord games, play them back at different speeds — tells you lots of things." Simon gives full credit to Durell colleagues Robert White and Dave Cummings. Julian Breeze did the music — "It would have taken me 10 years to do it."

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* Note due to memory limitations ACE on the C16 and VIC20 (+8K Ram) do not have any ground objects.

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Screen shots are for CBM 64 version. Other versions may vary.

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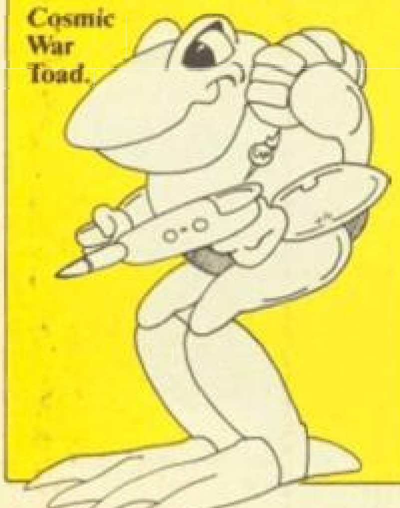
The Ocean

Transformers, Streethawk, Knightrider, Rambo and V — names that might make up an evening's TV /Video viewing. But as any Transformers fan will know, nothing is what it seems — thanks to Ocean all these action-packed names are turning into computer games. Along with the licenced Konami arcade games scheduled for release on Ocean's Imagine label, this adds up to a veritable tsunami of software from the three-year old company.

Does a licensed computer game necessarily make a killing? Group Chairman David Ward emphasises that it's the creative process of making software that's important. "Licensing just helps us to position the product. It's all to do with being part of contemporary society."

The Imagine label, now owned by Ocean, is at the moment releasing home computer versions of Konami arcade games — a different form of licensing from using TV or film-related ideas. "There are only about 20 original games in the whole life of the industry — rather than just plagiarise, we prefer licensing other people's ideas." Ocean plans to move beyond the arcade. The new Ocean IQ label plans to release Laser Basic and Laser Compiler for Spectrum, CBM-64 and Amstrad, along with music software, a screen designer and a Pascal.

Heavy stuff, agrees David Ward: "The IQ label is to do applications packages for the same machines that Ocean markets for. We've got to grow up with our customers at the same time as getting new ones. A different label is necessary because people are used to arcade games from Ocean. You don't expect to open a tin of Heinz beans and find condensed milk in it."



Cosmic War Toad.

Licensing is a tricky business. Transformers — the robot toys which turn into trucks or aircraft — were an obvious chase due to the massive success of both toys and TV series around last Christmas. But at the time Ocean acquired the rights to Sylvester Stallone's Rambo movie, they didn't face much competition.

"It was before Reagan's remark about knowing what to do next time he faced a hostage situation. That made it something else", says Ocean managing director Jon Woods. "Also, in my view, there's something of a depressed market in the States. New machine formats are coming along, so not much is being developed for the Commodore 64. Rambo was a surprise success, with not much prior licensing, unlike say Goonies which attracted a lot of attention becuse it had Spielberg's name on it."

A silicon Rambo

The silicon Rambo is a real epic with the combined talents of Daley Thompson's Decathlon and Hunchback II programmers Tony Pomfret and Dave "I'm starting to forget all the games I've written" Collier, plus Martin Galway on music and Steve "I used to be just an ordinary person" Wahid on graphics.

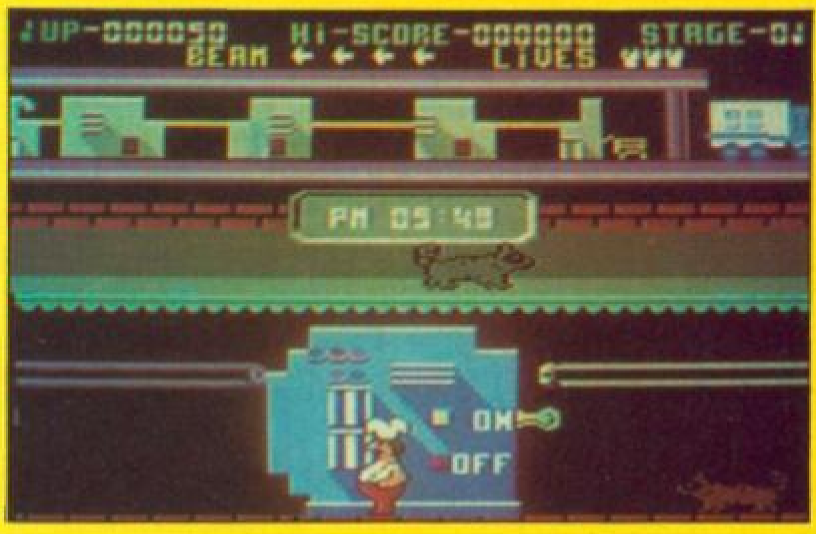
Although Martin Galway has added in self-composed passages of music the original pounding bass and swooping synthesiser sounds remain and music even plays while loading. "It's not loading the whole time — there are 50 times a second when it can play music." The morse code in the loading tune is actually tapping out a real secret message, so have your note pads at the ready and you may learn something to your advantage.

Although Martin has a number of instruments at Ocean HQ in Manchester, an upright piano and a Seiko DS-320 synthesiser, his preferred machine is the Yamaha CX-5. He has also worked on the sound effects, everthing from approaching helicopters to the various mortars and machine guns the deadly dogface has festooned around his person. Remarks that the game itself resembles Alligata's Whos Dares Wins — subject to legal action from Elite (they claim it infringes their license to the arcade game Commando) — are quickly rebuffed.

"In those games you can only move upwards, and you only have a gun and hand grenade. In this you have all the weapons that Rambo has in the film." Certain sections of the game have to be completed silently. Once the first prizoner is rescued from his crucifix in the stockade you can forget about the knife and the arrows and really let rip. But you've got to collect the additional weapons from around the screen, acquiring them in the same way as the morose militarist arms himself in the movie.

You can blast your way through the jungle, but a river blocks your escape. Naturally you steal a helicopter and fly back to the compound to rescue the other inmates a la Choplifter.







Top: Rambo. Centre: Comic Bakery. Above: Yie Ar Kung-Fu.

wave

Paul Bond is all at sea with Ocean.

Chances are that a giant helicopter will give chase as you fly back up the screen, so it's non-stop action all the way.

When two tribes go to war there are plenty of points to be scored as Denton Designs who programmed Frankie Goes To Hollywood for Ocean well know. This Christmas it will be the two tribes of Transformers — Autobots v Decepticons — who will be fighting it out on computer screens worldwide, thanks to Denton's Tony Sanders and Ally Noble (graphics).

Collect energy pods

The goal of the game which features music from the TV show is to collect all the components parts of the Transformers' mask emblem. If the Decepticons collect the 15 pieces before you do, you lose. As one of the five Autobots, Optimus Prime (turns into a truck), Hand (turns into a jeep), Mirage (turns into a racing car), Bumblebee (turns into a VW Beetle) and Jazz (turns into a Porsche) you move around the ramps and levels on the screen, hounded by the flying Decepticons. As a vehicle you move faster across the ground, but as a robot you can fly and fire.

As you move about you must also collect energy pods, and you can use defensa-pods to switch control from one robot to another without destroying it. The five robots in existence appear icon-style at the base of the screen. "At first we were going to have a different screen for each Transormer. Then we changed it to one large scrolling map" says Tony Sanders.

It's not all licensed games that Denton are doing for Ocean as Ally Noble is quick to point out — a new game under the working title Cosmic War Toads is "sort of a Denton in-joke", she says. "We used to make up these silly ideas for a game with toads in, then we thought it might be a good idea to actually make it into a program." So you might expect the action to take place in blackest outer space, and you might be ready for one of the mini-environments to be a lily-pond — but a plate of frogs' legs in a French restaurant? Or beef sausages cooked in batter (toad-in-the-hole, geddit?)

You score Toad points by finding and killing Regellian slime-beasts — the slime master and his slime pawns. You can also delay their progress and the use of pond stones. Along with War Duck — the webbed warrior — and Porkula the cosmic vamp you are embroiled in the struggle to make the world a safer place to spawn.

Konami is a name popular amongst people who like pushing coins in slots — now courtesy of Ocean's Imagine label, you can save the wear on your wallet. Yie ar Kung Fu on Spectrum, CBM-64 and Amstrad is a colourful addition to the growing mass of martial arts simulations; along with Comic Bakery, basically a good solid platform game, and Mikie, initially on the Spectrum all these arcade hits will be available at Christmas.

Mikie is set in an American high-school — "Failure teaches success" — declaims a motto on one of the blackboards. He has to put together parts of a message whilst winning the hearts of the young co-eds; at the same time he is harassed by teachers, janitors and the muscle-bound football team. Colin Gresty and the inscrutable Joff are two of the Ocean programmers involved in the Konami work. Joff uses a Tatung Einstein to develop the Z-80-based versions of the programs. "The assembler is really brilliant, a pleasure to use."

Ocean have managed to tie up licenses for both the modern-day knights in shining armour currently tearing across TV screens around the globe — Streethawk and Knightrider. The initial game plan includes facility for synthesised speech and possibility of up to four different scenarios. The baddy in this program is SKARR, a vehicle duplicating Michael Knight's robot supercar KITT.

Built by a hostile foreign power, the vehicle is a real argument for state-subsidied free public transport, since it wants to do things like murder the El Salvadorian president whilst giving a talk in Los Angeles, nuke the New York World Trade Centre, kill the US President, and sabotage a shuttle carrying an SDI Star Wars satellite. Apart



from discouraging such boisterousness, Mr Knight and KITT have to find the smuggled Russian (oops, there I said it!) gold which is financing the operation. There will be a number of variables in the game, so it will be different each time it is played.

In Streethawk the hero and his computerised motorbike have the job of defending a female VIP from a gang of kidnappers.

The V sign to aliens

Computer games, like theatrical productions, can mutate considerably before their first night, so some ideas may be dropped and others added. At the moment the game plan for Ocean's program based on the space reptile soap opera "V" gives you the chance to totally annihilate the aliens' mothership and save humanity from becoming an interesting little item on the galactic menu.

The top two-thirds of the screen will show a scrolling network of air-vents and corridors deep within the heart of the Visitors' Mother Ship. Some of these corridors will lead into large open spaces, whilst others will lead into laboratories and storage rooms. Air-locks will lead onto the outer surface of the Mother Ship. Occasionally the player will find doorways leading to "Horizontal Lifts", or transporters.

The bottom third of the screen is used for hand-held communicator/computer and associated status information. Alternatively, the screen will show a number of icon-driven options which the player can take.

The Mother Ship itself is layed out in six vertical planes as indicated by figure 1. Each plane is built from 128 different screens. Each screen wil utilise eight building blocks of 8 × 6 characters.

The actual "map" of each plane will be randomly generated



Left: Steve Blower, art director of Ocean. Above: David Ward.

at the beginning of each game so there will be plenty of variety.

You, of course, are Donovan the rebel leader and only man on earth who can act with his hairline. You guide him around the mother ship armed with a gun which can kill the visitors but not the robots. The communicator/computer section of the screen has a map of the level you are currently on and can be used to confuse the aliens' central computer.

If they pump gas into your sector you'll have to grab some oxygen cylinders. And if he leaves the ship, Donovan better be wearing a helmet. Certain tasks must be performed outside the ship — mainly destroying the main water inlet or destrying the main communications centre. Other tasks to complete may include destruction of various electrical generators, disabling the air purification plant and sabotaging the central computer.

Veterans of the Starship Paradroids will be pleased to know that the Visitor's robots are divided up into sensor robots (which can see Donovan in the dark), cleaner robots which float at head height firing lasers, security robots which bob up and down and zap, together with maintenance robots. But they are useful to Donovan, insofar as he can trick them into opening doors that he can't.

The game promises to be well within the Ocean tradition of not only integrating real elements of the licensed original, but also creating a grippling and innovative computer game. Will this policy lead to their gobbling up their rivals like Diana polishing off a hamster? We shall see.




The Commodore 128.
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TERRORMOLINOS

▶ CBM 64/Spectrum/BBC/Electron/Amstrad ● Melbourne House

Our man with the brass lamp and the key to a thousand mysteries sheds light on new adventure programs. Lost? Never fear, Hugo North is here.

From the authors of Hampstead comes yet another original and hugely entertaining adventure. Let me warn you now that if you're intending to go to Spain for your holiday next year, this game is likely to make you want to change your plans.

Your objective is not to slay wicked sorcerers, duff up dragons or track down the 200 lost treasures of Trantos. No, no, those are a piece of paella compared with this game. What you are faced with here is one of the most perilous assignments known to English mankind — survive a two-week package holiday with the wife and kids in sunny Terrormolinos. And you must bring back 10 snapshots to prove it.

Before you can even set off for the Hotel Excrucio in Terrormolinos, you must first pack, naturally. Just as in real life, things you want are never where they should be and something always goes wrong at the last minute. The taxi's waiting outside but where the heck has little Doreen got to? Where did you put that camera? And what's that white gunge seeping out of the suitcase you've just packed.

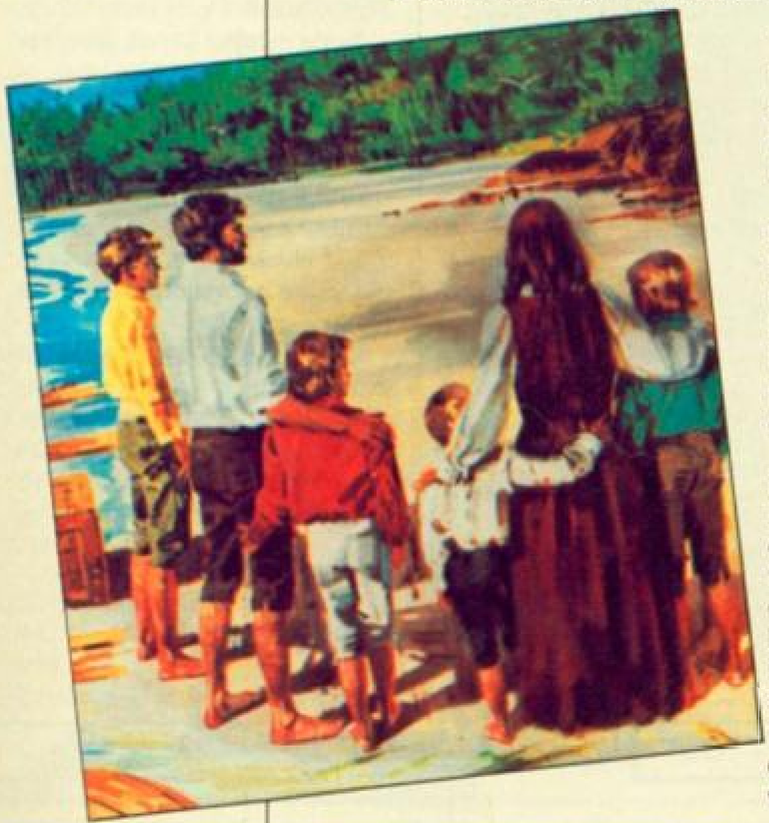
One feature that makes this text adventure even more of a giggle is that every time disaster strikes, a colour snapshot of your misfortune is displayed on screen in glorious Saucivision.

A real hoot of a game, and novel with it. If you like a good guffaw, Terrormolinos will tickle your fancy.



SWISS FAMILY ROBINSON

▶ Commodore 64 ● Windham Classics



This one impressed me right from its opening animated sequence of windtossed ship and accompanying thunder and lightning.

The top two-thirds of the screen are used mainly for simple but effective graphical representations of each location and any objects lying around. The lower portion is used for text input and output.

The game is very user-friendly and has many innovative features. For example, it will complete in full any abbreviated commands you enter, will highlight the command only if it is relevant to the current situation and will offer help, including a list of appropriate commands and their use, when you ask for it.

You begin on board the wrecked ship. Your first task is to search for and collect suitable supplies and then to find a safe way off the ship and to the nearby tropical island for you and the rest of the family.

Your ultimate aim is to survive and be rescued from the tropical isle. Even though you should be familiar with the plot of this classic tale, you'll still need all your creative wits to survive and reach a successful conclusion.

This is a big (over 220 locations) adventure, thoughtfully designed, with lots to do and plenty of stimulating challenges to grapple with. Highly recommended.

THE CRYSTAL BALL

H.A.L.A. (Hints Archive for Lost Adventurers) is a new postal reference service for adventure devotees. And it's free. All they ask in return is a S.A.E. and any maps, clues, etc. for any adventure that you have already completed so that they can keep on expanding their adventure archives.

The service sounds fast and comprehensive. If you're interested, why not write to Sonia Griffiths-Glover (Keeper of the Archive) at 38 Bellfield Drive, Well Lane, Willerby, East Yorkshire HU10 6HQ.

A HELPING HAND

Simon Wicklowson of Nottingham and Paul Bradford of Southampton are having trouble with Spiderman. Ringmaster a problem?
BONK NRUT NEHT BONK HEUP MOOR RETN ESEY ERUO YESO LC

Can't start the presses?
ELAC SEHT NOEL POEP ONID ULCN IELB ISSO PONI HTYR EVET UP

Mrs. Pritchard of BFPO 43 is baffled in Lords Of Time. Cavemen a problem?
(a) TIPM ORFR ORRI MTEG
(b) SURU ASOT NORB TARO PRIM EVAW NEHT SEVRE LEVR W
(c) NEME VACR AENR ORRI MPOR D

Carlo Rossi of Milan is stymied in Zork I. Can't open the jewelled egg?
TILA ETSF EIHT EHTT EL

Make it live

Last month we saw how "tree structures" can sort different conditions. If you missed that instalment, don't worry, because you'll find it quite easy to pick up the thread ths month when we show you how to adapt these programming techniques for you own use.

Just to recap, we designed a tree like that shown in figure 1 to sort a number of conditions relating to a prisoner in a dungeon. If you examine the tree, you should be able to follow the logic of it, which in pseudo-Basic might be expressed as a series of If statements, like this:

IF (the player in the dungeon) AND (there are rats present) AND (the rats are hungry) THEN PRINT "AAAAAGH!"
IF (the player is in the dungeon) AND (there are rats present
AND (the rats aren't hungry) THEN PRINT "LUCKY YOU!"
IF (the player is in the dungeon) AND (there are no rats present)...

and so on. As you can see, we need quite a few If statements to sort all the connections, and a tree structure enables us to do theis more economically.

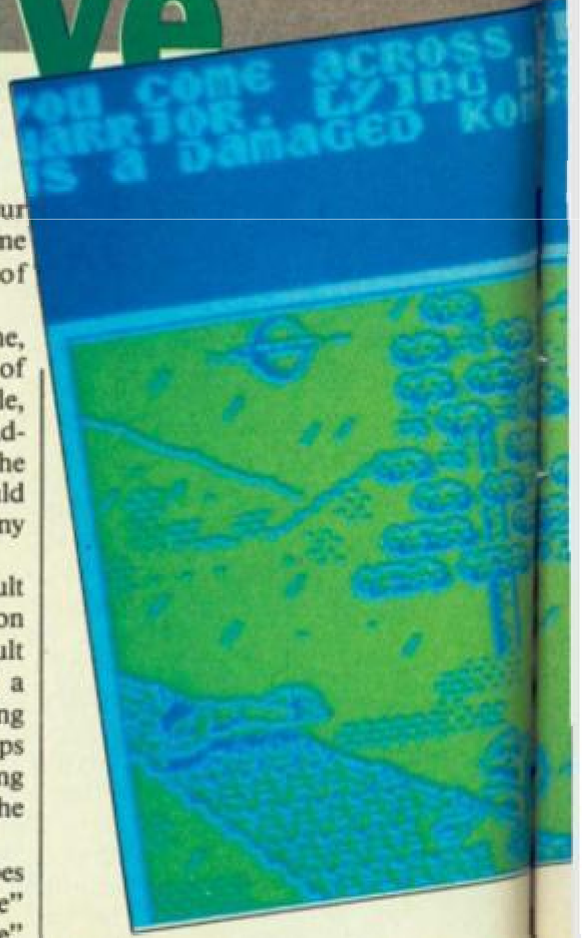
We also discussed the different types of nodes which go to make up the tree, and dealt with two basic types: terminal nodes — which have no branches leading from them; and choice nodes — which test a condition and then branch accordingly.

If you look at figure 1, you can see the various nodes labelled with either a C or a T depending on their type. If we store in an array the information about each node — its typed, and, 'if it's a choice node, the condition it tests plus to nodes it jumps to we can then write a simple routne which will start at node 1 and run down through the tree. We'll see this in action in a moment.

A simple affair

The tree in figure 1, however, is a very simple affair. We want to be able to design a tree that will enable us to handle interactive character in an adventure game, or any other task we care to tackle, and for these sort of applications something rather more complex is required.

If you look at figure 2, you'll see another tree again designed, to test conditions relating to our imaginary prisoner, but this time there are a number of differences.



First, you will notice not one, but three different types of terminal node. For example, node number 16 is just a dead-end. If the program sorting the tree were to arrive here, it would simply exit without taking any action.

Node 3, however, would result in the printing of a message on exit, and node 15 would result not only in the printing of a message, but also the carrying out of certain actions, perhaps clearing the screen, or adjusting some variables relating to the prisoner's status.

We can call these three types of terminal node a "simple" terminal node, a "message" terminal node, and an "action" terminal node. Not only are there different types of terminal node, but there are also different types of choice node.

Node number 2, needs to test a condition that in this example hasn't yet bee set up, so it first needs to jump to a routine that asks the player for the necessary information. In other words, before proceeding it has to jump out of the tree, ask a question, and then proceed accordingly. This is called a 'proceudre' node.

Node number 14, on the other hand, is a simple choice node — the condition it tests has already been set up during the program and stroed in a variable — in this case by the procedure noe number 1 — so it simply checks it and carries on accordingly to the value, true or false, that it finds there.

Sometimes, however, we *might* want to jump to one of more than just two different nodes. Supposing that in our adventure game there are three guards wandering around the dungeon,

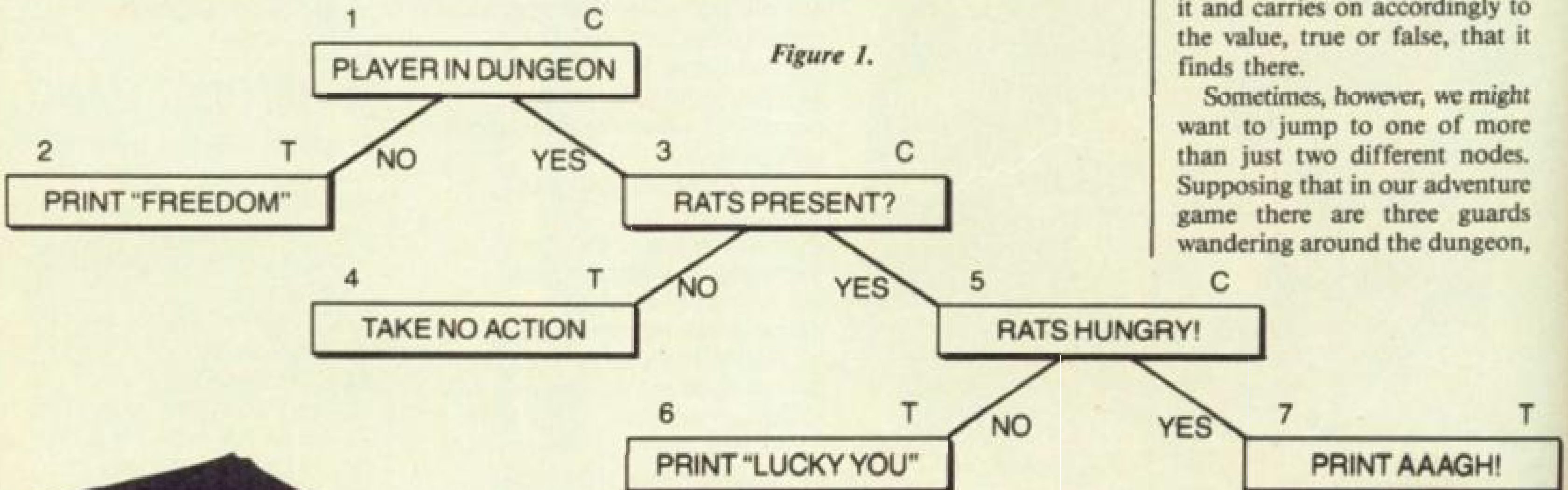
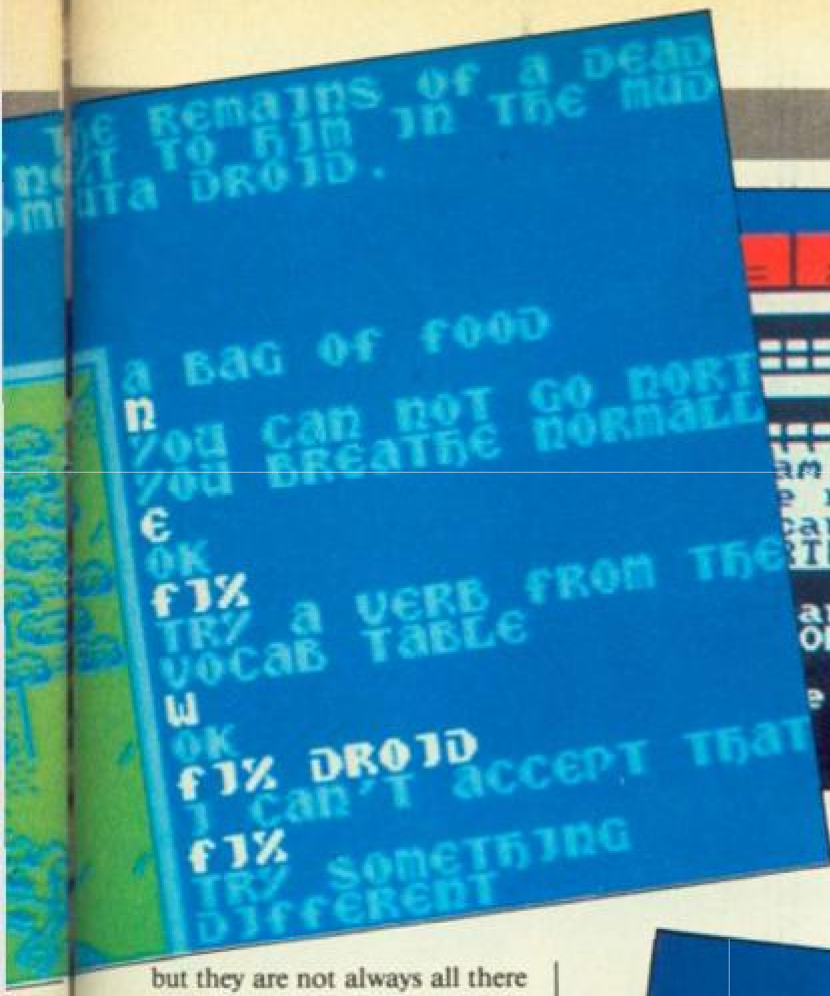
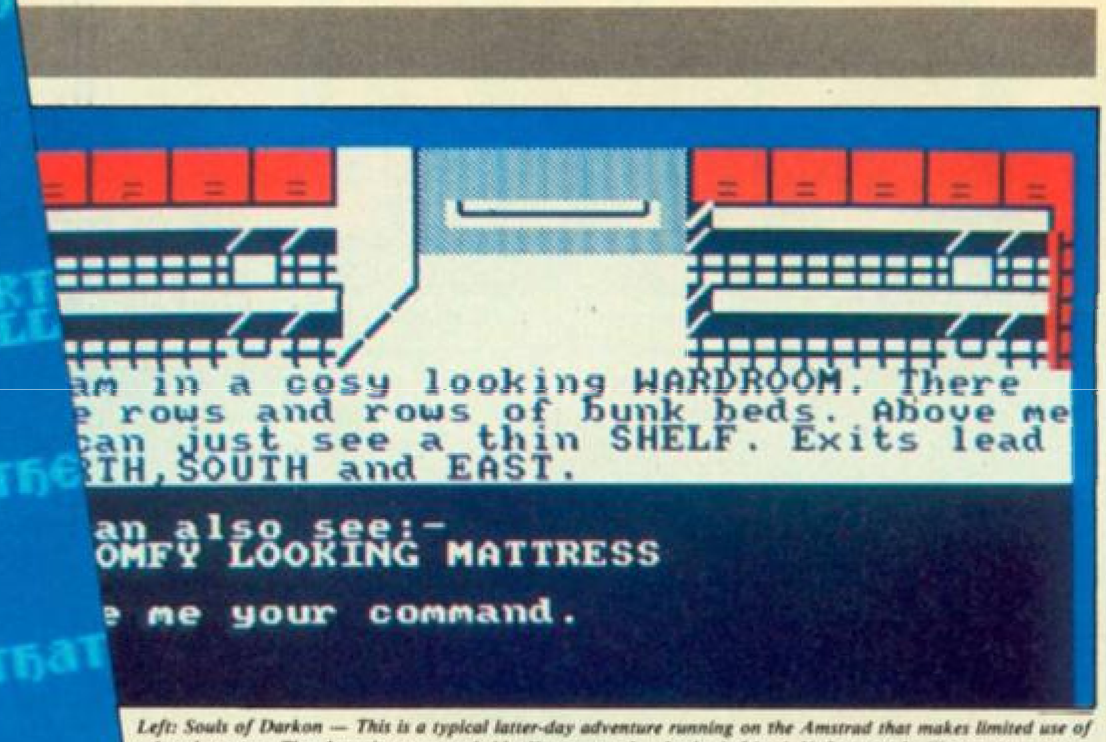


Figure 1.

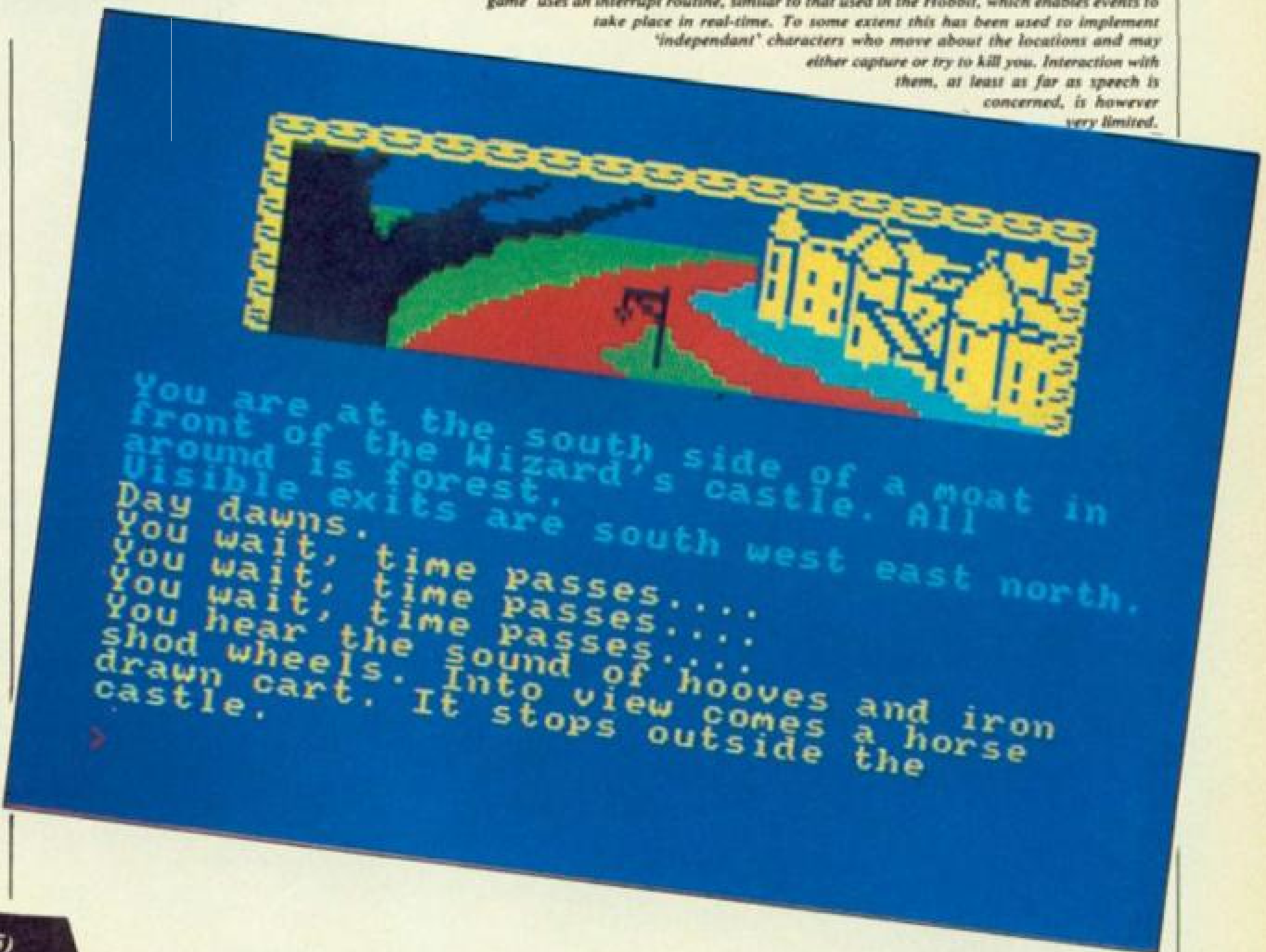
Listing 1.

```
10 REM ********************************
20 REM initialise arrays
30 REM ********************************
40 REM
50  DIM  t(17,4):  REM tree  array  - 16
nodes each with four data items
60  DIM c(2):  REM two conditions to  be
stored for testing
70   DIM  m$(13):   REM  there  are   13
different messages
80  REM read data into tree array - four
data items for each of 17 nodes
90  FOR n=1 TO 17:  FOR d=1 TO  4:  READ
t(n,d): NEXT d: NEXT n
100 REM read messages into m$(13)
110 FOR n=1 TO 13: READ m$(n): NEXT n
120 REM
130 REM ********************************
140 REM sort through tree
150 REM ********************************
160 REM
170 n=1: REM start at node 1
180  ON t(n,1) GOTO 220,320,370,450,510,
600,670
190 REM --------------------------------
200 REM choice nds (t(n,1)=1) jump here
210 REM --------------------------------
220  n=t(n,c(t(n,2))+3):  GOTO 180:  REM
value held in t(n,2)...
230 REM ...is used to select a condition
from the c array...
240  REM ...the value of which (true  or
false) is added to 3 to get...
250  REM  ...the new  node  number  from
either t(n,3) or t(n,4)
260  REM ...the program then jumps  back
to line 180 to carry on down...
270 REM ...the tree
280 REM --------------------------------
290 REM .....simple terminal nodes.....
300 REM .....(t(n,1)=2)  jump here.....
310 REM --------------------------------
320 END
330 REM --------------------------------
340 REM .....action terminal nodes.....
350 REM .....(t(n,1)=3)  jump here.....
360 REM --------------------------------
370  GOSUB  760:   REM  jump  to  action
routine via jumpblock
380 IF t(n,4)=0 THEN END: REM no message
so end
390 GOSUB 1020:  REM select message  and
print
400 END
410 REM --------------------------------
420 REM ....message terminal  nodes....
430 REM .....(t(n,1)=4)  jump here.....
440 REM --------------------------------
```





Left: Souls of Darkon — This is a typical latter-day adventure running on the Amstrad that makes limited use of other characters. The player is accompanied by Komputa, a loyal robotic friend. Unfortunately, like so many games, the character doesn't really play much of a role, and interaction with it is virtually non-existent. Above: Subsunk is one of a vast number of games that have been produced using the Quill. Unfortunately there is no provision on the Quill for introducing true interactive characters though they can be simulated. Below: Ashkeron! — This game uses an interrupt routine, similar to that used in the Hobbit, which enables events to take place in real-time. To some extent this has been used to implement 'independant' characters who move about the locations and may either capture or try to kill you. Interaction with them, at least as far as speech is concerned, is however very limited.



but they are not always all there at the same time — we might want to jump to one of three different routines according to how many guards are present. Node 9 does just this, and we can call this type of choice node a "multiple choice" node.

Numbered sequentially

Note that the three nodes it jumps to are numbered sequentially — this is because at runtime the program will test for the number of guards and calculate the node to jump to by adding that number to the lowest-node-number-to-branch-to minus one. So one guard will cause a jump to node 13 (12+1), two guards to node 14, and so on. In this particular instance there can only be a maximum of three guards.

Finally there's a random choice node number 7 which is similar to a multiple-choice node, but rather than test a condition it simply generates a

(continued on page 55)

```
450 GOSUB 1020: REM select message and
print
460 END
470 REM ---------------------------------
480 REM ....random branching nodes....
490 REM .....(t(n,1)=5) jump here.....
500 REM ---------------------------------
510 r=t(n,2): GOSUB 1030: REM get a
random number in range indicated...
520 REM ...by t(n,2)
530 n=t(n,3)+r-1: REM get new node
number by adding random offset, minus
one...
540 REM ...to base node held in t(n,3)
550 GOTO 100: REM jump back to carry on
down tree
560 REM ---------------------------------
570 REM .....multiple choice nodes.....
580 REM .....(t(n,1)=6) jump here.....
590 REM ---------------------------------
600 n=(t(n,3)-1)+c(t(n,2)): GOTO 100:
REM add value of condition...
610 REM ...held in element of c array
pointed to by t(n,2) to...
620 REM ...base node number (held in
t(n,3)) minus 1 then carry on down tree
630 REM ---------------------------------
640 REM ...procedure nodes (t(n,1)=7)..
650 REM ...........jump here............
660 REM ---------------------------------
670 GOSUB 840: REM jump to relevant
procedure via procedure jumpblock
680 GOTO 100: REM new node number has
already been assigned during...
690 REM ...the procedure, so return to
carry on down tree
700 REM
710 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
720 REM action terminal node jumpblock
730 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
740 REM
750 REM (one entry only here)
760 ON t(n,2) GOSUB 780
770 RETURN
780 CLS: RETURN
790 REM
800 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
810 REM ......procedure jumpblock.....
820 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
830 REM
840 ON t(n,2) GOSUB 860,890,910,930,950
850 RETURN: REM jump back to carry on
down tree
860 PRINT m$(t(n,4));: INPUT i$: IF
(i$<>"Y") AND (i$<>"y") THEN c(1)=0:
GOTO 880
870 c(1)=1
880 n=2: RETURN: REM jump back and carry
on down tree starting at node 2
890 PRINT m$(t(n,4));: INPUT i$: IF
```

(listing continued on page 55)

Make it live

(continued from page 53)

random number within a particular range of intergers, in this case 1 to 3. It then, adds that number to the lowest node number, here 10, minus one to detemine which node to jump to next.

As you can see, there are now seven differnt types of node to deal with — you can see which ones are which in figure 2 as they've been labelled according to the key in the diagrom. We're now going to program this tree in Basic to show you exactly how it's done — and it really couldn't be easier. Take a look at the program listing and then read through the following notes.

First we initialise three different arrays to hold data for our tree, for the conditions that will be initialised by nodes one and eight, and for the different messages that will be printed. This is done in lines 50 to 70.

Data for the tree

Next, we enter the data for our tree. The table shows the different items that need to be recorded for each node, and figure 2 shows, alongside each node, the data that needs to be eintered for it. Node number 5, for example, has the figures 7,4,0,5 beside it, and if you refer to the table you can see that this means that:

1) This node is a " procedure node", type 7
2) It calls procedure number 4
3) It will result in the printing of message number 5.

This data is read into the array t(17,4) in line 90.

Having set up the tree array and the message array, we now proceed directly to traversing the tree. The code number is held in the variable n, and since we want to start at node 1, this is set accordingly in line 170.

Line 180 then checks the first data item for that node (t(n,1) to find out what type of node it is — terminal, message, or whatever. The program then jumps to the correct routine. A choice node, for example, checks the value of the relevant condition in the c array which will be pointed to by t(n,2).

The program is heavily Remmed in this section to help you see what's going on, so I shan't waste sapce by repeating what's already there. Note, by the way, that you can delet the Rem lines if you really want to — there are no jumps to Rem lines in the program.

By checking each node in turn, the program traverses the tree, printing messages, getting inputs, and jumping to the appropriate nodes until it reaches a terminal node. If you want to see exactly what's going on, amend line 180 to read:

```
180 PRINT "I am now at
node";n; ON t(n,1) GOTO
220,320,370,450,510,600,670.
```

and you'll see the program actually moving down through the tree node by node. You can also make this amendment for debugging purposes if the program doesn't seem to be doing what you want it to.

There are a couple of other points to note about this listing. All actions and procedures called by the program are vectored via jumpblocks in lines 760 and 840. The reason for this is that when we come to design some really complex trees in the next issue for our character handler, this is the program structure we shall adopt.

The second thing to note is the way the program is carefully divided into sections. With a small tree such as the one we are dealing with here, this may seem to make the program unnecessarily long, but again, when we come to develop more complex routines, we shall be splitting up the program in a similar way.

Next month, we sall present a complete example of the use of this method in producing a fully-fledged character handler.

A certain degree of efficiency has been sacrificed in this listing to make it compatible with a large range of micros. However, some changes will still need to be made by owners of BBC, Spectrum, and Commodore computers. These are listed here:

BBC

```
1050 r = RND(r): RETURN
```

Commodore

```
780 PRINT "<SHIFT/CLEAR>":
RETURN
```

Spectrum

```
70   DIM m$(13,40)
180  RESTORE 2000: FOR x = 1 TO
     t(n,1): READ y: NEXT x: GOTO y
760  GOSUB 780
840  RESTORE 2100: FOR x = 1 TO
     t(n,2): READ y: NEXT x: GOTO y
1050 LET r = INT(rnd*r) + 1: RETURN
2000 DATA 220,320,370,450,510,600,
     670
2100 DATA 860,890,910,930,950
```

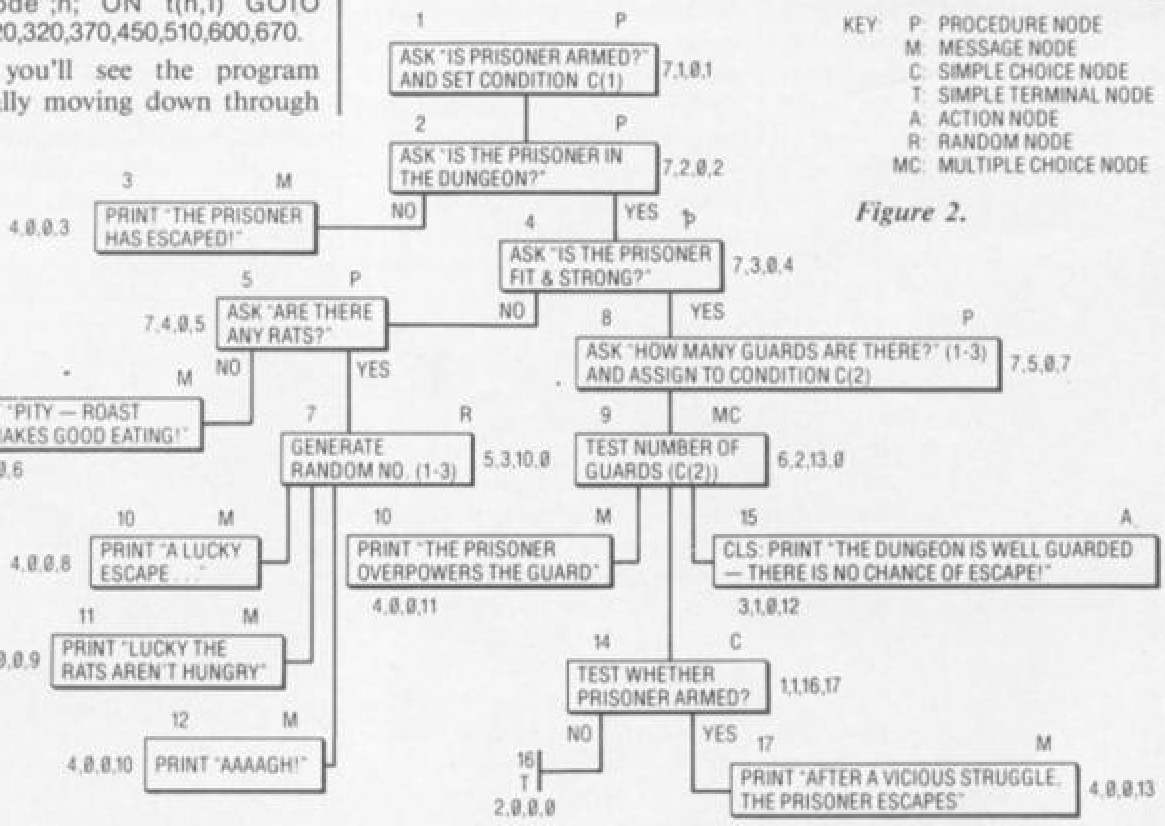


Figure 2.

(listing continued from page 53)

```
(i$<>"Y") AND (i$<>"y") THEN n=3: RETURN
900 n=4: RETURN
910  PRINT  m$(t(n,4));:  INPUT  i$:  IF
(i$<>"Y") AND (i$<>"y") THEN n=5: RETURN
920 n=8: RETURN
930  PRINT  m$(t(n,4));:  INPUT  i$:  IF
(i$<>"Y") AND (i$<>"y") THEN n=6: RETURN
940 n=7: RETURN
950 PRINT m$(t(n,4));: INPUT i: IF (i>3)
OR (i<1) THEN 950
960 c(2)=i: n=9: RETURN
970 REM
980 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
990 REM             subroutines
1000 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1005 REM
1010 REM...select AND PRINT a message..
1020 PRINT m$(t(n,4)): PRINT: RETURN
1030 REM ...generate a random number...
1040 REM ...in range  indicated by r...
1050 r=INT(RND(1)*r)+1: RETURN
1060 REM
1070 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1080 REM ..........node data...........
1090 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1100 REM
1110  DATA  7,1,0,1,7,2,0,2,4,0,0,3,7,3,
0,4,7,4,0,5,4,0,0,6,5,3,10,0
1120  DATA 7,5,0,7,6,2,13,0,4,0,0,8,4,0,
0,9,4,0,0,10,4,0,0,11,1,1,16,17
1130 DATA 3,1,0,12,2,0,0,0,4,0,0,13
1140 REM
1150 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1160 REM ........ message data.........
1170 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1180 REM
1190  DATA "Is the  prisoner  armed","Is
the prisoner in the dungeon"
1200 DATA "The prisoner has escaped","Is
the prisoner fit and strong"
1210  DATA  "Are there any  rats","Pity!
Roast rat makes good eating!"
1220 DATA "How many guards are there (1-
3)","A lucky escape from the rats!"
1230  DATA  "Luckily  the  rats   aren't
hungry!","Aaaaaaagh!!!     Eaten      by
rats!!!"
1240  DATA "The prisoner overpowers  the
guard"
1250 DATA "The dungeon is well guarded -
there is no hope of escape..."
1260  DATA "After a vicious struggle the
prisoner escapes!"
```

Chess

John Dawson checks out chess.

There's a false mythology about chess; you don't have to be a genius to play well and enjoy hours of concentrated excitement. Indeed, genius in one field is no indicator of brilliance in another. Alan Turing, probably the most brilliant mathematician involved in breaking the German ENIGMA cipher during the Second World War, is said to have been "an absolute duffer" at playing chess.

However, with the development of microcomputer chess programs and portable sensory chess sets, you don't even need a human opponent. This has the great advantage that when you are losing you can simply switch off the thing that's wiping the floor with you.

The programs and chess computers in table 1 actually play chess, generally according to the rules, and generally they are capable of beating you, unless you are a regular player with some experience. Some of the programs will offer you a good game at quite a high level of competence.

The **Chess King Pocket Micro** set is the only one of the four dedicated machines that does not have a "sensory" board. Instead, moves are keyed into the computer using the six keys at the bottom of the computer panel.

These keys shift automatically between the letter and the number depending upon whether you are entering the first or second co-ordinate of a piece's position. The other four keys control the level at which the machine plays LV, make the machine play the next move MO, and clear an incorrect entry CE before it is entered into the program EN.

Clearly the Chess King's input/output is greatly simplified compared to the multiplexed eight column by eight row input and 16 light emitting diodes — LEDs — output in the other three machines. This simplicity is reflected in the Chess King's single chip and simple printed circuit board.

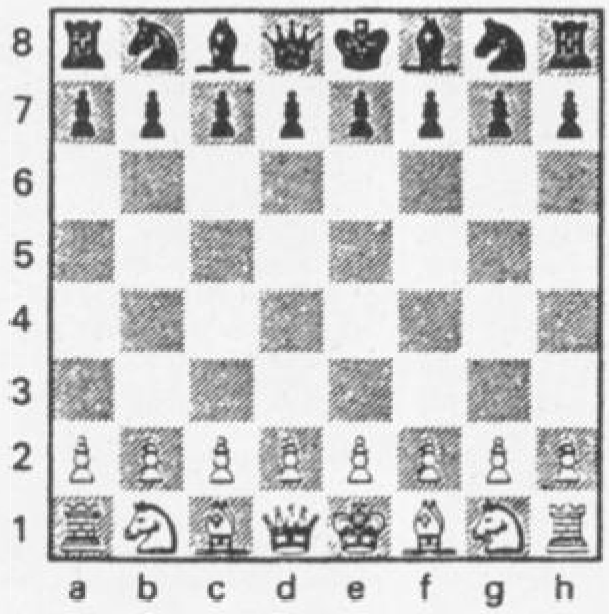


Figure 1: The opening position of all the pieces.



Figure 2: Part of the Chess King instruction manual.

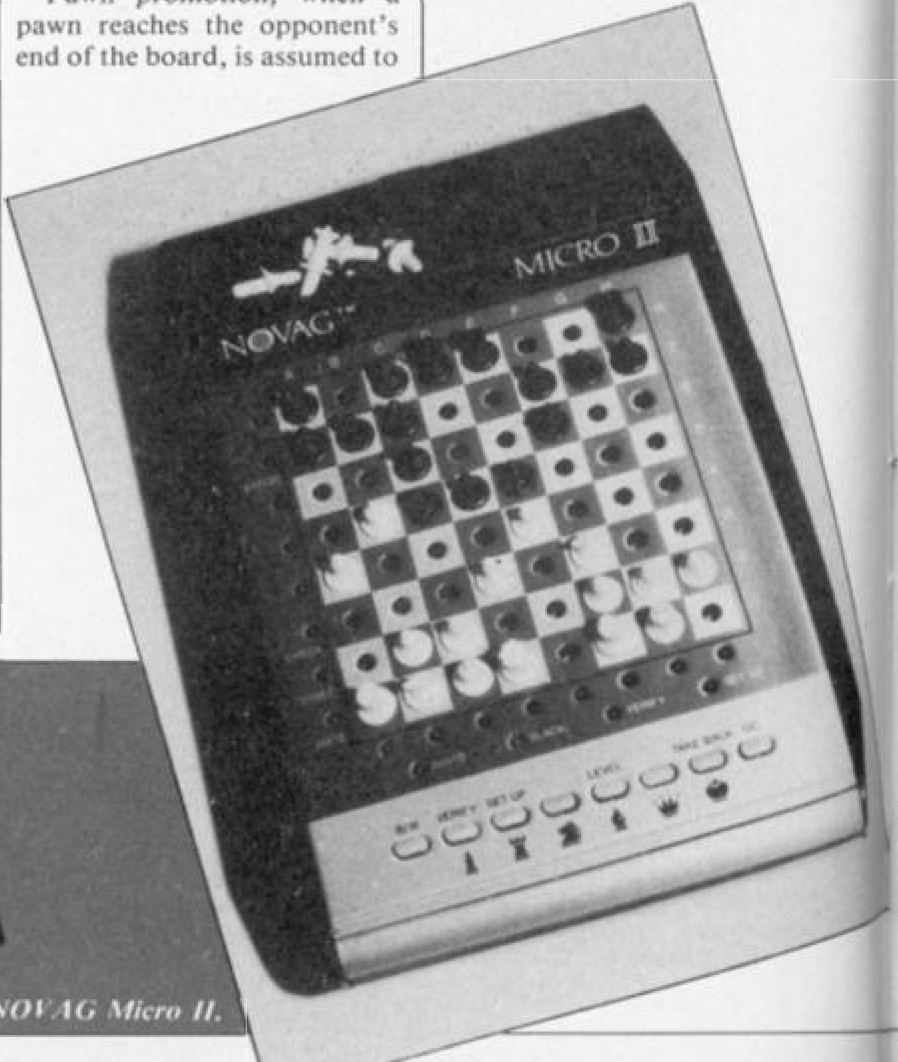
The board folds in two and makes a neat package in a soft plastic case about 19.5 by 6.5 by 2.5 cms. Battery life is said to be about 400 hours and there is a recessed on/off switch on the side of the case. The pieces on the board are punched from a strip of magnetised plastic. There are no spare pawns or Queens which makes life unnecessarily difficult if you, or the machine, succeed in promoting or exchanging a pawn for a Queen or another piece in the course of the game.

The CGL GrandMaster program was written by White and Allcock Ltd but the manual for the Chess King does not state the origin of the machine code held in the chip. It is a limited program both by the standards of the other machines and the software for the BBC, QL and Amstrad computers.

The Chess King has only four levels of play and, while the number itself is comparatively unimportant, the highest — strongest — level allows the machine only eight to 24 seconds on average to formulate its next move.

Pawn promotion, when a pawn reaches the opponent's end of the board, is assumed to be to a Queen while the rules permit the player to choose to promote the pawn to a Queen, Rook, Bishop or Knight. Switching the machine off erases the current game and the Chess King sets up a new game automatically when switched on.

Probably the most important failing in the Chess King is the inability to verify where all the

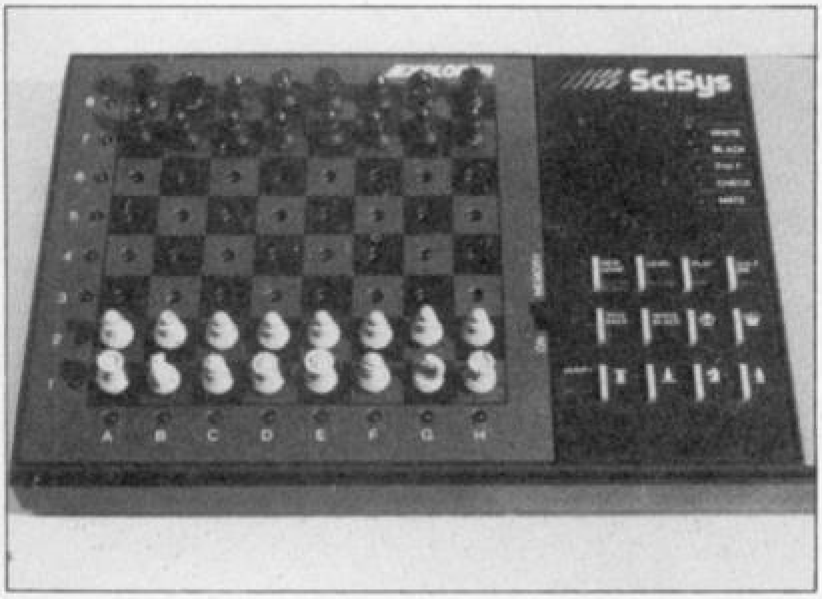


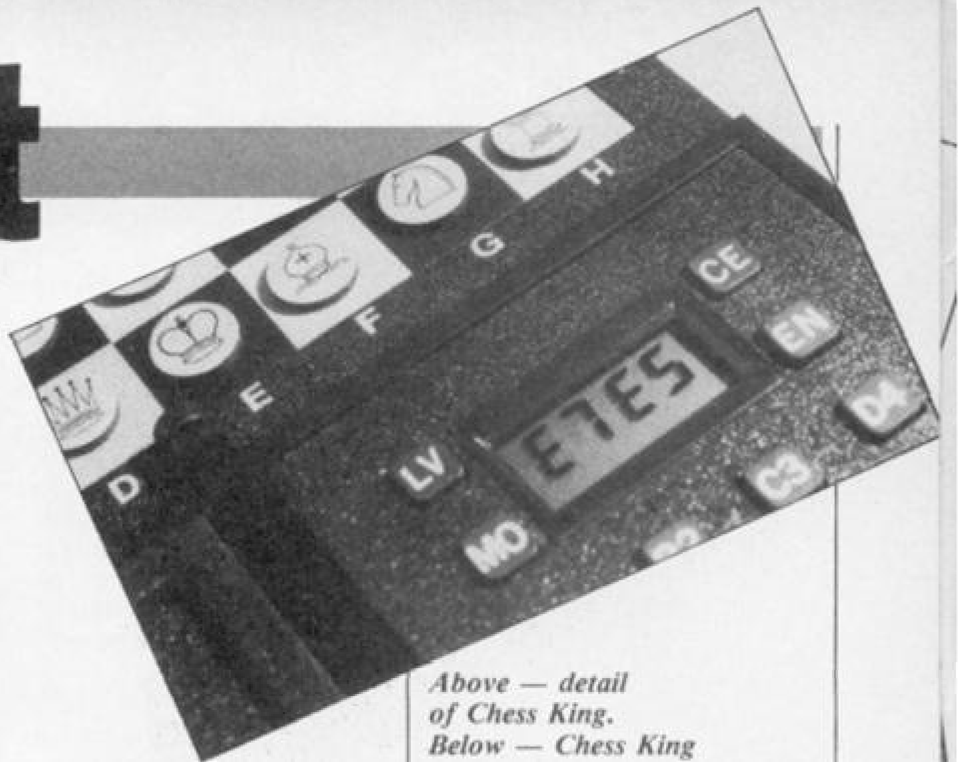
NOVAG Micro II.

Table 1.

Micro II	NOVAG	Hong Kong
Explorer	SciSys	Hong Kong
Chess King	Computer Games Ltd	England
Grandmaster	Computer Games Ltd	England
White Knight Mk 11/12	BBC	UK (BBC)
Cyrus II	Amsoft	UK (Amstrad)
3D Voice Chess	CP Software	UK (Amstrad)
QL-Chess	Psion	UK (QL)
Colossus Chess 4.0	CDS Software Ltd	UK (Commodore 64)

s check-out





Above — detail of Chess King. Below — Chess King Pocket Micro. Left — SciSys Explorer.

pieces on the board are placed in the computer's memory. Nothing is more frustrating than setting up a devious trap only to find that the machine couldn't care less because it thinks one piece is somewhere else entirely.

There is no way to take back a move nor to review the moves that have been made other than by writing them down as you go along. However, at £22.95 in North Oxfordshire it is the cheapest dedicated machine to be found and it is very portable.

The **NOVAG Micro II** also uses a single chip to hold the program and play the game. The chip is a traditional 40 pin integrated circuit and figures 4 and 5 show the printed circuit board with the output LEDs and the two plastic membranes that form the sensory board.

A move is made on a sensory by pressing the piece into its socket until two LEDs light up to indicate the current row and column — rank and file in chess terminology — of the piece.

The piece is removed from its socket and pressed down into the new location until the computer beeps to indicate that the move has been accepted. The computer's move is indicated by lights in the same way, the position of the piece to be moved is indicated and when it has been depressed the destination co-ordinates light up.

The NOVAG Micro II is 7 by 5 by 1.5 ins. in size and shares several of its functions with the **SciSys Explorer** chess computer. The Explorer machine is 7.5 by 4.5 by 1.5 ins. and is the most sophisticated of the three dedicated computers. Figure 3 sets out the hardware configuration and software specification for the various machines and programs.

The Micro II failed to spot a potential 3 move draw when playing against the Explorer and then did not indicate that the draw had occurred while the Explorer lit up the appropriate LED to indicate a stalemate or draw. I have taken none of the machines through the series of repetitions necessary to provoke a draw according to the 50 move rule but as all the machines are unable to take back more than four half moves at best — the Explorer can backstep through two White/Black moves at some stages of the game — it seems unlikely that any of the machines has the capacity to detect a sequence of 50 identical moves.

Indeed, the Explorer instructions say honestly: "In the case of a stalemate or draw by immediate threefold repetition, only the Mate light will be turned on"; by implication excluding the possibility of a 50 move draw.

The SciSys Explorer has both the best program and the best design of the machines I have looked at. The Explorer predicts what your next move is likely to be and then thinks while it is waiting for you to move of

(continued on next page)



Chess check-out

(continued from previous page)

what's the best reply it can make. Neither the Micro II nor the Chess King do this and clearly it increases the power of the program considerably.

Colossus 4.0 and **QL-Chess** both think in their opponent's time and you can turn off this feature which makes the program weaker; that's to make you feel even smaller when you lose the 10th successive game. The compartment on the right hand side of the Explorer board holds the spare pieces safely, a good range of functions are given by the "function" keys, three AA cells provide more than 100 hours use and the machine will store the state of a game for up to one year when the power switch is turned to "memory".

The SciSys machine has a good set of standard opening moves — the "book" — which it plays quickly and decisively so long as your responses match its expectations. Unlike some early chess programs, the Explorer seems to have no trouble moving from its openings book to the middle game. Most chess computers are comparatively weak — by good players' standards — when the majority of pieces have been captured and the war on the board enters the "endgame".

Martin Bryant wrote **White Knight Mk 11** and **Mk 12,** and is responsible also for the Commodore 64 program Colossus Chess 4.0. The instructions for the programs are very similar and clearly the architecture of the software is a progression from one program to the next.

There is an interesting series of comparisons in the back of the instructions for Colossus Chess 4.0 between micro-computer chess programs for the Apple II, Spectrum, Atari, Dragon, Electron, Oric and ZX-81 computers. Colossus 4.0, running on an Apple II, beat everything in sight including both versions of Colossus is supplied with a number of demonstration games for tutorial purposes.

The **QL-Chess 3D** display is a lot of fun and, like Martin Bryant's programs, plays a good strong game of chess. However, the plan view provided in Colossus 4.0 and the White Knight series is clear and gives unequivocal information about the state of the game.

CONCLUSIONS

The dedicated chess machines have some real advantages over either another human player or a program running on a microcomputer.

- You can learn by playing just some of the moves of a game over and over again. I have found it very instructive to see how the Explorer deals with the first 10 or a dozen moves. Very few human opponents will put up with so selfish an approach.
- The real pieces in the NOVAG and SciSys machines give a true perspective and allow you to 'walk round' the board in a way that even the best 3D programs cannot simulate yet.
- You can play chess on a train or bus, at the seaside, anywhere you like with one of the dedicated machines.

Conversely, the chess programs may suffer from being too strong for many beginners even at the lower levels of play. One form of handicapping that used to be popular was for the stronger player to give the other one or more pieces at the start of the game.

The machines and programs with a Set-up mode allow you to take away a Rook or some other piece from the computer before the game starts. Colossus 4.0 also allows you to handicap the computer by cutting down the time available for it to compute its moves.

Either a dedicated chess computer or one of the programs could make a really long lasting Christmas present. But the machine and its instructions alone are not sufficient unless there is a good chess player in the same household.

The SciSys Explorer is the best of the sensory chess computers that I have seen. It's available from Dixons or, in a different colour scheme, from Tandy.

Figure 3.

Software/Machine	NOVAG Micro II M	SCISYS Explorer M	* CGL Chess King M	CGL GrandMaster M	BBC White Knight S	AMSOFT Cyrus II S	CP SOFT 3D Voice S	CDS SOFT Colossus S	PSION QL-Chess S
MACHINES									
Sensory	YES	YES	NO	YES					
Battery life	20 hours	100 hours	400 hours	not known					
Main power	YES	NO	NO	not known					
Price	£39.95	£39.95	£22.95	£54.95	£12.95		£12.95		
SOFTWARE									
Levels/Modes	8	9	4	not known	many			many	22 (36)
Minimum time	'Instantly'	2 seconds	5-11 secs		'0 seconds'			'0 secs'	2 secs or less
Maximum time	5-20 mins	2 hours	8-24 secs		very large			very large	'infinite'
Time equality									
Tournament mode									
max. depth of search	not stated	not stated	not stated	not stated			'7 moves'	12 ply	not stated
verify pieces	YES	YES	NO	YES	unnecessary	unnesessary	unnecessary	unnecessary	unnecessary
Set up pieces	YES	YES	NO	YES	YES	YES	YES	YES	YES
Force program move	NO	YES	NO	not known	YES			YES	YES
Take back move	YES (2)	YES (2-4)	NO	YES	YES (120 max)	YES	YES	YES (120 max)	YES (to start)
Analysis	NO	NO	NO	NO	NO	NO	NO	NO	YES
Clock times	NO	NO	NO	NO	YES	YES	YES	YES	YES
Save state of game	NO	YES	NO	NO	(YES Mk 12)	NO	NO	YES	YES
Print moves	NO	NO	NO	NO	NO	NO	NO	NO	YES
Replay game	NO	NO	NO		YES			YES	YES
Backstep game	NO	NO	NO		YES			YES	YES
Player v Player	NO	YES	NO		YES			YES	YES
3D display	real pieces	real pieces	counter pieces	real pices	2D plan view	3D display	3D display	2D display	2D/3D display
RULES									
Stalemate	YES	YES	partial	YES	YES			YES	YES
Draw	NO	3 move	NO		YES			YES	YES
En passant	YES	YES	YES	YES	YES	YES	YES	YES	YES
Castling	YES	YES	YES	YES	YES	YES	YES	YES	YES
Underpromotion	YES	YES	NO	YES	YES	YES	YES	YES	YES
Lose 'on time'	NO	NO	NO	NO	NO	NO	NO	YES	NO

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Sampling

N-n-n-nineteen eighty five has been the year of the sampler. Now you can imitate the effects as Tony Sacks reports.

Have you ever wanted to conduct the Berlin Philharmonic Orchestra? Or to have Mark Knopfler play for you in your living room? Well, these and a thousand other fantasies can now come true through the miracle of sampling.

All you need is a micro, a box of electronics and matching software, and you too could be producing some of the dramatic effects that pepper the works of Duran Duran, the Thompson Twins, Paul Hardcastle, and many other contemporary musicians.

The theory of sampling is simple. You take a sound — either from a microphone or directly from your hi-fi or an electronic instrument — and chop it into lots of tiny segments, each usually lasting less than one-thousandth of a second. These segments are then digitised and tucked away in the recesses of you micro's memory.

When you want to play back the sound you squeeze the digitised data back through a digital-to-analogue converter to reconstitute the sound and send the signal to an amplifier. All being equal, you should get a recognisable rendition of your original sound blasting out of the loudspeaker.

If the hardware is well designed, the quality of a sampled sound is determined largely by the rate at which the original sound was chopped into segments — and hence the size of the segments. This rate is known as the sampling frequency. As a rule of thumb, the sampling frequency should be twice the highest frequency you want to hear, so that to hear a frequency of 15kHz — towards the top of the audible range — you would need to sample at 30kHz or higher.

So far, so good. But the higher the sampling frequency, the quicker your micro's limited memory is gobbled up, and the shorter the sample will last. For example, Supersoft's Microvox sampler for the Commodore 64 will give you less than a second of sampling time at its maximum sampling frequency of 42kHz.

This may be sufficient for short percussive sounds but when you want to sample a sound like a piano which may take several seconds to die away, you've got problems.

There are two possible solutions. First you can reduce the sampling frequency which means that you will lose some of the higher frequencies in the sampled sound. This may or may not be noticeable, depending on the sound, but it will give you a longer sample. The Microvox, for example, provides a maximum sample length of 17.4 seconds at a frequency of 2kHz.

The second approach is to sample at a high frequency but to use some nifty software to doctor the playback. If, immediately after reading the sampled sound out of memory, all or part of the sample is re-read, you can give the impression of an extended sound. This trick, called looping, can be repeated to give a continuous sound. Some samplers will even decrease the amplitude of the output gradually to give the impression of a sound dying away

You may not be aware of it, but many of the percussion sounds on recent rock records are the work, not of sweating musicians but of electronic "drum boxes" pumping out sampled sounds.

Percussive sounds are ideal for sampling because they tend (with some notable exceptions) to be rather short-lived and to have limited bandwidths. Individual sounds can thus be squeezed into relatively small chunks of memory and several different sounds can co-exist in a micro's memory.

It is not surprising therefore that among the first batch of sampling products for micros are two drum simulators. What is more surprising is that whereas dedicated drum machines cost several hundred pounds each, the two micro-based packages, for the Commodore 64 and the Spectrum, cost just £65.00 and £29.95 respectively, and yet produce stunningly realistic and powerful sounds.

As with the other sampling systems described on these pages, the sounds produced by these drum simulators are digital recordings of real sounds. Their quality bears no relation to the types of sounds you are used to from your micro's internal sound system. They have to be heard to be believed.

But unlike the other sampling systems, these packages do not allow users to produce their own samples. Instead the suppliers provide ready-sampled sounds on disc or cassette together with the software to combine these souinds rhythmically, and a relatively simple digital-to-analogue hardware decoder.

The Commodore drum machine, called the Syntron Digidrum, was developed in the Netherlands and is being distributed in Britain by Syndromic Music. The Spectrum package, dubbed the Specdrum, is a home-grown product from Cheetah Marketing and is being sold only by Boots. An Amstrad version, expected to sell for around £35.

Although the two drum simulators are not strictly rivals — unless you don't own either a Spectrum or a Commodore — it is interesting to compare the approaches adopted by the two design teams.

In many ways the two systems are very alike. Both squeeze eight different percussive sounds into the sampling memory. Both allow up to three of these sounds to be played back simultaneously but restrict the choice to one sound from each of three groups. Both provide a grid display for the user to construct rhythm patterns, and both allow

Above right: Muzix-81, Microvox, SFX and DMS.
Below: SFX in greater detail



samplers



naturally.

Looping is just one of many ways is which the sampled sound can be manipulated once it is in a micro's memory. The most obvious of these is to change the read-out frequency. If you read out the data at twice the sampling frequency you will get the same sound an octave higher — and lasting half as long. Similarly, halving the read-out frequency will drop the sound by an octave. Intermediate frequencies produce intermediate notes.

Most samplers allows you to select limited portions of the sampled sound for playback or manipulation. Using this facility, you can pick out the solo flute sound in the middle of a sampled orchestral flourish, for example. It also means that part of as sample can be repeated several times to give Paul Hardcastle's stuttering "n-n-n-nineteen" effect.

Some samplers provide real-time effects to produce doctored versions of the original sound almost instantaneously. For example, by playing back a sound just after it has been fed into the sampler, a variety of effects such as echoes and reverberation can be generated, depending on the length of the delay.

Another popular real-time effect is to shift the pitch of the playback sound. If you treat your voice in this way, you can make yourself sound incredibly butch — or, if you prefer, give yourself a falsetto. It is even possible to perform a duet with yourself.

The £249.95 ZX-81 sampler, called **Muzix-81**, was developed by a pair of Hungarian musician-boffins and is being distributed in the UK by Vulcan Electronics. It turns out that the ZX-81's relatively simple internal architecture lends itself to sampling although its memory has to be boosted by the addition of a 64K Rampack. This gives it a 1.6 second maximum sample length at a very respectable 37kHz sampling frequency.

The quality of the sounds produced, and the facilities offered by the Muzix-81 rival those of the best of the Commodore-based systems. Indeed it has one very useful command not offered on the CBM samplers. This automatically looks for matching segments of sound during a looping operation to make the joins almost inconspicuous.

Where the Muzix-81 does fall down is in the diabolical keyboard and limited graphics capabilities of the ZX-81. The graphics limitations are especially apparent when the Muzix-81 tries to produce an oscilloscope-type display of the sampled sound.

These displays, common to all of the sampling packages, help the user to visualise the sound and to select looping points. Not surprisingly, the Commodore-based samplers do a much better job than the ZX-81. These relatively minor problems should be overcome in a Spectrum version of the Muzix-81, due soon.

Another possible drawback to the Muzix-81 is that it has to be controlled by an analogue synthesiser. Before the digital age dawned with synthesisers commonly used an as all recent analogue control system in which an increase in one volt would produce a one octave rise in pitch. The Muzix-81 is designed to be driven by such a synthesiser which you could probably pick up fairly cheaply on the second-hand market, but electronic musical equipment is geared to MIDI, this seems a retrograde step.

One sampler which does allow for control from a MIDI keyboard is Supersoft's £225 **Microvox** package for the Commodore 64. This is a well thought-out sampler with a wealth of facilities — as its price would indicate.

In addition to versatile and easy-to-use sample-taking and manipulating controls, the Microvox includes a real-time delay effects section and a "sequencer". This allows you to record, and subsequently edit, a series of single notes played on a MIDI keyboard in real time. These notes can be

(continued on next page)

series of these patterns to be linked together to form "songs".

However, there are distinct differences between the two systems. The Digidrum has been designed to maximise the amount of memory available for sample storage, sometimes at the expense of user-friendliness.

The Specdrum designers have devoted a greater proportion of the micro's memory to the control program, with the result that it is easier to use and slightly more versatile than the Digidrum. The price they pay is slightly inferior, but still perfectly acceptable, drum sounds.

One particular attraction of the Specdrum not available on the Digidrum, is the option of real-time programming. Both systems allow you to enter drum patterns, in your own time, as points on a time-v-instrument grid, but, at present, only the Specdrum allows you to tape out the rhythms on the computer keyboard and have these entered automatically on the grid. For many people, this more intuitive approach is preferable. The Digidrum designers are said to be working on a real-time version of their sytem.

There are differences too on the hardware front. The Digidrum has a socket which pumps out timing pulses for external devices such as synthesizers and dedicated drum machines suitably equipped to follow its timing instructions.

The Specdrum prefers to take its orders from the outside world and will synchronise its activities with signals fed through the EAR socket of the Spectrum. This allows it to stay in time with instruments recorded on different tracks of a multi-track tape recorder, for example.

Sampling systems such as the Specdrum and Digidrum are only as good as the sampled sounds supplied for them. Both systems come with a useful assortment of sounds — the Specdrum having a basic "kit" of eight and two alternative sounds; the Digidrum having two full kits, one conventional, the other made up of tinkly, butt effective, glass sounds.

Both also include a variety of rhythm patterns and "songs", which serve the dual roles of demonstration pieces and instructive examples of the programming art.

Sooner or later you will probably tire of the original set of sounds, so both suppliers are wisely planning to support their systems with further sampled sounds on disc and/or cassette. The first back-up set of more than 40 new sounds for the Digidrum is already available at a cost of £16.50.

Sampling samplers

(continued from previous page)

stored as up to 24 different "pattern" which can be linked together to form a "song".

The sampler allows you to store simultaneously up to 16 different sampled sounds, or "voices", provided that there is enough memory. The sequencer can be instructed to play different notes using different voices, thus adding to the richness and the variety of the output. It can, for example, be used to simulate a set of percussion instruments, and a "kit" of sampled drum sounds is provided as part of the Microvox software.

The Microvox's almost total reliance on MIDI for control is both a strength and a weakness. The main drawback is for would-be users who do not possess a MIDI keyboard and cannot afford the £500-plus cost of a keyboard and sampler.

For such people a slightly cheaper alternative exists in the form of the £199 **Digital Music System** — DMS — from Microsound. In addition to MIDI, this system also offers the options of controlling the sampler either from the Qwerty keyboard — possibly using a clip-on miniature musical keyboard such as those from Commodore or Siel — or from the company's own £99 full-size, four-octave musical keyboard.

The DMS allows the user to select a sample rate of between 4kHz — which gives 8s of barely recognisable sound — and 33kHz — which produces 1s of high quality sound. It does not offer any real-time effects, but does include a modulation source which can be used to tinker with the sampled sound to produce interesting effects. It also provides an envelope function with variable attack, decay and sustain characteristics to shape the sampled sound.

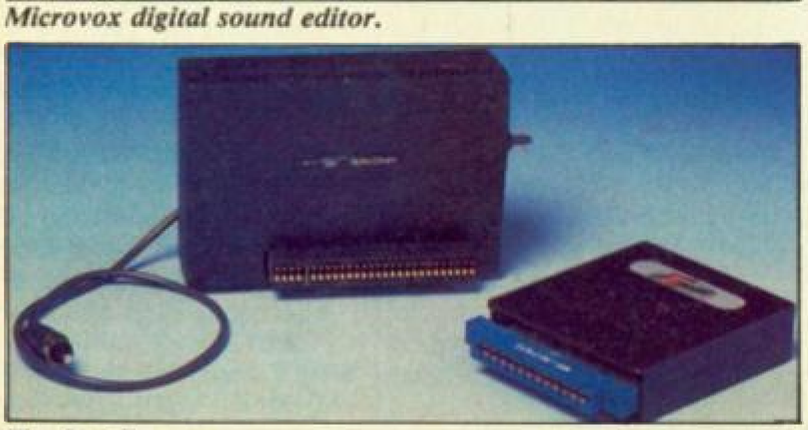
The DMS and Microvox samplers are aimed, both in quality and price, at the serious musician. But a pair of Commodore-based samplers at a more accessible price for the less dedicated experimenter, should be on the market by the time you read this.

The first of these is from Commodore itself. It is a product of the company's collaboration with Music Sales which has resulted in sophisticated software for the SID chip and the £100 Sound Expander synthesizer add-on for the CBM-64/128.

The £69.99 **Commodore Sound Sampler** comes complete with a-microphone and plugs into the cartridge port of the 64 or 128. A useful option not provided with other samplers is the possibilty of playing back the sampled sounds through a television speaker; the other systems rely on you having an amplifier close to your micro. An optional £24.99 MIDI adaptor can be plugged into the Commodore sampler module to give MIDI control of the sampled sounds.



Microvox digital sound editor.



The SpecDrums.

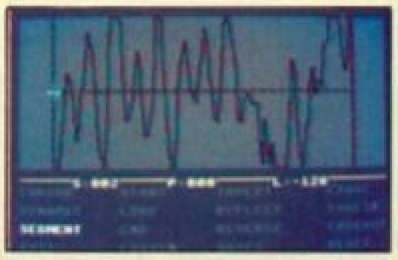
The Commodore software is based on easy-to-use pull-down menus. In additon to straight sampling, it offers two types of real-time effect: delays from 20 milliseconds to 2 seconds; and pitch transposition of up to an octave above or below the original sound.

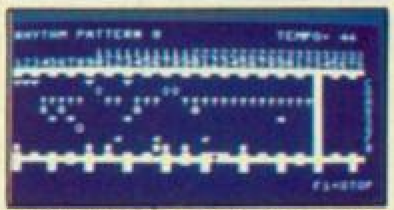
Four different short sounds can be stored simultaneously and played back using a very rudimentary sequencer. As with Supersoft's Microvox, this facility is used to simulate a drum machine and two four-instrument sampled drum kits are provided as part of the software, Unfortunately, the Commodore's 16-note "sequencer" is such a basic affair that it is little more than a gimmick.

Although the Commodore sampler does offer very good value for money, it is clear that some corners have been cut to achieve this. For example, there is no choice of sampling frequency, the fixed rate being at 20kHz, providing samples up to 1.4 seconds long. The resulting sounds, although good, are not quite up to the standard of the sampler's more expensive rivals.

Even cheaper than Commodore's sampler is the £49.99 **Digital Sound Sampler** from Datel. Earlier this year Datel brough out a sampler for the Spectrum which was little more than a toy, producing sampled sounds of rather poor quality and offering a minimum of functions. The company claims that the Commodore version is a vast improvement, with better designed electronics and software written in machine code, not Basic as was used of the Spectrum version.

The Datel sampler, which was not yet available for review as we went to press, provides a variety of real-time effects and includes a step-time sequencer.





It is designed to be controlled from the Qwerty keyboard, possibly using a clip-on musical overlay.

The possibility of MIDI control was looked at but discarded on cost grounds. But as a spin-off, Datel plans to produce a separate MIDI interface which will be sold as a package with MIDI real-time and step-time recorders at the remarkable price of £39.95 — less than half the price of some existing CBM-64 MIDI interfaces!

In many respects, the **DS:3** for the Apple II is like its less costly counterparts, but it does have one significant advantage. Whereas the other samplers we have looked at are all monophonic — only one sound can be played back at a time — the DS:3 is polyphonic, allowing up to four notes to sound simultaneously.

Sampler suppliers.

Cheetah Marketing, 1 Willowbrook Science Park, Crickhowell Road, St. Mellons, Cardiff (0222-777337)

Commodore Business Machines, Corby, Northamptonshire NN17 1BR (0536-205252)

Datel Electronics, Unit 8, Fenton Industrial Estate, Dewsbury Road, Fenton, Stoke-on-Trent (0782-273815)

Greengate Productions, Unit D, Happy Valley Industrial Park, Primrose Hill, Kings Langley, Hertfordshire WD4 8HZ (09277-69149)

Microsound, PO Box 14, Petersfield, Hampshire GU32 1HS (0703-87403)

Supersoft, Winchester House, Canning Road, Wealdstone, Harrow HA3 7SJ (01-861 1166)

Syndromic Music, 35A Grove Avenue, London N10 2AS (01-883 1335)

Vulcan Electronics, 200 Brent Street, London NW4 1BY (01-203 6366)

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Interrupt-driven

Many popular video games nowadays have music ringing in the background during play. The Amstrad CPC-464 computer has some excellent facilities for sound generation but attempting to add background music to a Basic program using the Every instruction generally gives poor results with the game being slowed down considerably.

The assembly language program presented here allows interrupt driven background music to be added to Basic programs through the use of some simple RSX-Resident System extension-commands. It also allows the us of one, two or all three sound channels.

The following commands are provided. Note that each one must be preceded by a vertical bar (Shift '@') symbol. A parameter enclosed in square brackets is optional.

(1). MUSICON ,t, a1 (,a2) (,a3) — turn on music. where t is the tempo (the length in fiftieths of a second, of the shortest available note) and a1,a2 and a3 are two less than the addresses of the data for channels 1,2 and 3 respectively.

(2). MUSICOFF — turn off music.

(3). VOLUME v,1 (,v2) (,v3) — set for channel (s), where v1, v2 and v3 are the respective amplitudes of channels 1,2 and 3.

(4). PAUSE — stop playing music.

(5). CONTINUE — continue playing music after pausing.

To enter the program, you can either enter and assemble the source code — listing 1 — using an assembler. I have used Devpac but any good one should do). Or if you do not have an assembler I have provided a Basic loader program — listing 2 — which should be typed in and Run to store the code in memory.

Once the code is in memory, it can be saved on tape (or disc) using the command

SAVE "MUSIC",B,&A000,&2A0 (enter)

To make the computer recognise the new commands the instruction CALL &A1C5 should be given. At this point the program can be tested by entering and Running listing 3 which tells the computer to repeatedly play all the notes available until a Musicoff command is given.

Any program using the extension commands should include the following line to load the code and log-on the commands MEMORY &9FFF: LOAD "!MUSIC":CALL&A1C5

The data for the music to be played through a channel is arranged as follows:-
byte 1 — duration of note 1 (1-127), byte 2 (upper nybble) — note 1 octave (0-5), byte 2 (lower nybble) — note 1 number (0-11), byte 3 — duration of note 2, byte 4 (upper nybble) — note 2 octave, byte 4 (lower nybble) — note 2 number......., 0

Once the music playing routine discovers the 0 in place of a duration number it then loops back to the beginning again. If bit 7 of the duration number is

Listing 1.

```
10 ; Amstrad background music
20 ; (c) 1985 Steve Dunlop
30 ;
40          ORG  &A000
50 TICKER:  DEFS 6
60 EBLOCK:  DEFS 7
70 POINTR:  DEFS 6
80 DELAY:   DEFS 3
90 DATA:    DEFS 6
100 NCHAN:  DEFW 0
110 TEMPO:  DEFW 0
120 VOLUME: DEFS 3
130 DEL:    DEFW 0
140 MUSON:  CALL RESMP
150         CALL RESSND
160         LD   C,&0
170         LD   A,7
180         CALL &BD34
190         LD   HL,EBLOCK
200         LD   B,129
210         LD   DE,MUSIC
220         CALL &BCEF
230         LD   HL,TICKER
240         LD   DE,30
250         LD   BC,(TEMPO)
260         CALL &BCE9
270         RET
280 MUSOFF: LD   HL,TICKER
290         CALL &BD0A
300         CALL &BCEC
310 RESSND: LD   D,3
320 RESSN2: LD   A,7
330         ADD  A,D
340         LD   C,0
350         CALL &BD34
360         DEC  D
370         JR   NZ,RESSN2
380         RET
390 RESMP:  LD   HL,(DATA)
400         LD   (POINTR),HL
410         LD   HL,(DATA+2)
420         LD   (POINTR+2),HL
430         LD   HL,(DATA+4)
440         LD   (POINTR+4),HL
450         LD   A,1
460         LD   (DELAY),A
470         LD   (DELAY+1),A
480         LD   (DELAY+2),A
490         RET
500 MUSIC:  LD   HL,DELAY
510         LD   BC,DATA
520         LD   DE,POINTR
530         XOR  A
540         CALL MUSIC2
550         LD   A,(NCHAN)
560         CP   1
570         RET  Z
580         LD   A,1
590         INC  HL
600         INC  BC
610         INC  BC
620         INC  DE
630         INC  DE
640         CALL MUSIC2
650         LD   A,(NCHAN)
660         CP   2
670         RET  Z
680         LD   A,2
690         INC  HL
700         INC  BC
710         INC  BC
720         INC  DE
730         INC  DE
740         CALL MUSIC2
750         RET
760 MUSIC2: DEC  (HL)
770         RET  NZ
780         PUSH HL
790         PUSH BC
800         PUSH DE
810         PUSH AF
820         LD   (DEL),HL
830         LD   A,(DE)
840         LD   L,A
850         INC  DE
860         LD   A,(DE)
870         LD   H,A
880         INC  HL
890         INC  HL
900         LD   A,H
910         LD   (DE),A
920         DEC  DE
930         LD   A,L
940         LD   (DE),A
950         LD   A,(HL)
960         CP   0
970         JR   NZ,MUSIC3
980         LD   A,(BC)
990         LD   (DE),A
1000        INC  DE
1010        INC  BC
1020        LD   A,(BC)
1030        LD   (DE),A
1040        LD   A,1
1050        LD   HL,(DEL)
1060        LD   (HL),A
1070 MUSIC6: POP AF
1080        PUSH AF
1090        ADD  A,8
1100        LD   C,0
1110        CALL &BD34
1120 MUSIC4: POP AF
1130        POP  DE
1140        POP  BC
1150        POP  HL
1160        RET
1170 MUSIC3: BIT 7,A
1180        JR   Z,MUSIC5
1190        RES  7,A
1200        LD   BC,(DEL)
1210        LD   (BC),A
1220        JR   MUSIC6
1230 MUSIC5: LD  BC,(DEL)
1240        LD   (BC),A
1250        INC  HL
1260        PUSH HL
1270        LD   A,(HL)
1280        AND  240
1290        SRL  A
1300        LD   E,A
1310        SLA  A
1320        ADD  A,E
1330        LD   E,A
1340        LD   D,0
1350        LD   HL,NOTDAT
1360        ADD  HL,DE
1370        LD   B,H
1380        LD   C,L
1390        POP  HL
1400        LD   A,(HL)
1410        AND  15
1420        LD   E,A
1430        SLA  E
1440        LD   H,B
1450        LD   L,C
1460        ADD  HL,DE
1470        POP  AF
1480        PUSH AF
1490        SLA  A
1500        PUSH AF
1510        LD   C,(HL)
1520        CALL &BD34
1530        POP  AF
1540        INC  A
1550        INC  HL
1560        LD   C,(HL)
1570        CALL &BD34
1580        POP  AF
1590        PUSH AF
1600        LD   HL,VOLUME
1610        LD   E,A
1620        LD   D,0
1630        ADD  HL,DE
1640        ADD  A,8
1650        LD   C,(HL)
1660        CALL &BD34
1670        JR   MUSIC4
1680 NOTDAT: DEFW &0777,&070C
1690        DEFW &06A7,&0647
1700        DEFW &05ED,&0598
1710        DEFW &0547,&04FC
1720        DEFW &04D4,&0470
1730        DEFW &0431,&03F4
1740 ;
1750        DEFW &03DC,&0386
1760        DEFW &0353,&0324
1770        DEFW &02F6,&02CC
1780        DEFW &02A4,&027E
1790        DEFW &025A,&0238
1800        DEFW &0218,&01FA
1810 ;
1820        DEFW &1DE,&1C3
1830        DEFW &1AA,&192
1840        DEFW &17B,&166
1850        DEFW &152,&13F
1860        DEFW &12D,&11C
1870        DEFW &10C,&FD
1880 ;
1890        DEFW &EF,&E1
1900        DEFW &D5,&C9
1910        DEFW &BE,&B3
1920        DEFW &A9,&9F
1930        DEFW &96,&8E
1940        DEFW &86,&7F
1950 ;
1960        DEFW &77,&71
1970        DEFW &6A,&64
1980        DEFW &5F,&59
1990        DEFW &54,&50
2000        DEFW &4B,&47
2010        DEFW &43,&3F
2020 ;
2030        DEFW &3C,&38
2040        DEFW &35,&32
2050        DEFW &2F,&2D
2060        DEFW &2A,&28
2070        DEFW &26,&24
2080        DEFW &22,&20
2090 ;
2100 ; add extension commands
2110 ;
2120 LOGRSX: LD  BC,COMTAB
2130        LD   HL,SPACE
2140        CALL &BCD1
2150        RET
2160 SPACE:  DEFS 4
2170 COMTAB: DEFW NTABLE
2180        JP   MONRSX
2190        JP   MUSOFF
2200        JP   PAUSE
2210        JP   CONT
2220        JP   VOLRSX
2230 NTABLE: DEFM "MUSI"
2240        DEFB "C","O","N"+128
2250        DEFM "MUSI"
2260        DEFB "C","O","F","F"+128
2270        DEFM "PAUS"
2280        DEFB "E"+128
2290        DEFM "CONT"
2300        DEFB "I","N","U","E"+128
2310        DEFM "VOLU"
2320        DEFB "M","E"+128
2330        DEFB 0
2340 ;
2350 ; music-on
2360 ;
2370 MONRSX: PUSH AF
2380        PUSH IX
2390        CALL MUSOFF
2400        POP  IX
2410        POP  AF
2420        CP   2
2430        RET  C
2440        CP   5
2450        RET  NC
2460        CP   2
2470        JR   Z,MON5
2480        CP   3
2490        JR   Z,MON4
2500        LD   A,3
2510        LD   (NCHAN),A
2520        LD   L,(IX)
2530        LD   H,(IX+1)
2540        LD   (DATA+4),HL
2550        INC  IX
2560        INC  IX
2570 MON3:   LD  L,(IX)
2580        LD   H,(IX+1)
2590        LD   (DATA+2),HL
2600        INC  IX
2610        INC  IX
2620 MON2:   LD  L,(IX)
2630        LD   H,(IX+1)
2640        LD   (DATA),HL
2650        INC  IX
2660        INC  IX
2670        LD   A,(IX)
2680        LD   (TEMPO),A
2690        CALL MUSON
2700        RET
2710 MON4:   LD  A,2
2720        LD   (NCHAN),A
2730        JR   MON3
2740 MON5:   LD  A,1
2750        LD   (NCHAN),A
2760        JR   MON2
2770 ;
2780 ; PAUSE
2790 ;
2800 PAUSE:  CALL RESSND
2810        LD   HL,EBLOCK
2820        CALL &BD0A
2830        RET
2840 ;
2850 ; CONTINUE
2860 ;
2870 CONT:   XOR A
2880        LD   (EBLOCK+2),A
2890        RET
2900 ;
2910 ; VOLUME
2920 ;
2930 VOLRSX: CP  0
2940        RET  Z
2950        CP   4
2960        RET  NC
2970        CP   1
2980        JR   Z,VOL2
2990        CP   2
3000        JR   Z,VOL3
3010        LD   A,(IX)
3020        LD   (VOLUME+2),A
3030        INC  IX
3040        INC  IX
3050 VOL3:   LD  A,(IX)
3060        LD   (VOLUME+1),A
3070        INC  IX
3080        INC  IX
3090 VOL2:   LD  A,(IX)
3100        LD   (VOLUME),A
3110        RET
```

music

set (just add 128), then the note is a rest otherwise 1 is the shortest note available, 2 is twic as long, 3 is three times as long etc. The octaves available correspond to octaves −2 to +3 shown in the CPC-464 manual appendix VII and in the firmware manual appendix VIII. e.g. bytes 2,52 define a note of duration 2, octave 3, note 4; 129, 0 define a rest of duration 1. A simple formula for working ot the second byte of a note is therefore:

byte stored = 16*octave + note

If you do not wish to type in the program I can supply copies of it on cassette for £4 each. Please include a 24 pence SAE. Write to: M.B.L. Dunlop, 19 Droridge, Dartington, Totnes, Devon, TQ9 6JG.



Background music can slow games down. But not with this power-pop from Myles Dunlop.

Demo program.

```
10 REM ** background music demo **
20 REM ** By Myles Dunlop        **
30 REM
35 CLS:PRINT"Please wait..."
40 MEMORY &9FFF:LOAD "!",&AØØØ:CALL &A1C5
5Ø a=&A3ØØ:GOSUB 1ØØØ
6Ø a=&A38Ø:GOSUB 1ØØØ
7Ø |VOLUME,15,15
8Ø |MUSICON,1Ø,&A3ØØ-2,&A38Ø-2
9Ø MODE 2:LIST
1ØØØ READ b:IF b=-1 THEN RETURN
1Ø1Ø POKE a,b:a=a+1:GOTO 1ØØØ
1Ø2Ø REM
1Ø3Ø REM channel 1 data
1Ø4Ø DATA 152,Ø,3,&37,131,Ø,134,Ø,3,&37,136,Ø,1,&37,3,&4Ø,1,&3b,1,&39,1,&3b
1Ø5Ø DATA 2,&4Ø,4,&37,3,&4Ø,1,&3b,1,&39,1,&3b,2,&4Ø,4,&37,3,&4Ø,1,&3b,1,&39
1Ø6Ø DATA 1,&3b,2,&4Ø,3,&37,141,Ø,Ø,-1
1Ø7Ø REM
1Ø8Ø REM channel 2 data
1Ø9Ø DATA 3,&34,3,&32,6,&3Ø,3,&34,3,&32,6,&3Ø,131,Ø,3,&35,6,&34,131,Ø,3,&35
11ØØ DATA 5,&34,129,Ø,3,&34,3,&32,6,&3Ø,3,&34,3,&32,6,&3Ø,3,&34,3,&32,3,&3Ø
111Ø DATA 13Ø,Ø,1,&35,3,&34,3,&32,6,&3Ø,Ø,-1
```

Listing 3.

```
10 REM ** music test prog **
20 MEMORY &8FFF
30 a=&9000                        ' start of data
40 FOR octave=0 TO 5
50 FOR note=0 TO 11
60 POKE a,1                       ' set duration
70 POKE a+1,16*octave+note        ' set octave & note number
80 a=a+2:NEXT note,octave
90 POKE a,0                       ' set end of data marker
100 |VOLUME,15
110 |MUSICON,15,&9000-2
```

Listing 2.

```
10 REM machine code loader
20 check=0
30 FOR I=&A000 to &A2A0
40 READ J:check=check+J
50 NEXT
1000 DATA 0,0,0,0,0,0,0,0
1010 DATA 0,0,0,0,0,0,0,0
1020 DATA 0,0,0,0,0,0,0,0
1030 DATA 0,0,0,0,0,0,0,0
1040 DATA 0,0,0,0,0,0,0,205
1050 DATA 100,160,205,86,160,14,60,62
1060 DATA 7,205,52,189,33,6,160,6
1070 DATA 129,17,130,160,205,239,188,33
1080 DATA 0,160,17,30,0,237,75,29
1090 DATA 160,205,233,188,201,33,0,160
1100 DATA 205,10,189,205,236,188,22,3
1110 DATA 62,7,130,14,0,205,52,189
1120 DATA 21,32,245,201,42,22,160,34
1130 DATA 13,160,42,24,160,34,15,160
1140 DATA 42,26,160,34,17,160,62,1
1150 DATA 50,19,160,50,20,160,50,21
1160 DATA 160,201,33,19,160,1,22,160
1170 DATA 17,13,160,175,205,176,160,58
1180 DATA 28,160,254,1,200,62,1,35
1190 DATA 3,3,19,19,205,176,160,58
1200 DATA 28,160,254,2,200,62,2,35
1210 DATA 3,3,19,19,205,176,160,201
1220 DATA 53,192,229,197,213,245,34,37
1230 DATA 160,26,111,19,26,103,35,35
1240 DATA 124,18,27,125,18,126,254,0
1250 DATA 32,26,10,18,19,3,10,18
1260 DATA 62,1,42,37,160,119,241,245
1270 DATA 198,8,14,0,205,52,189,241
1280 DATA 209,193,225,201,203,127,40,9
1290 DATA 203,191,237,75,37,160,2,24
1300 DATA 229,237,75,37,160,2,35,229
1310 DATA 126,230,240,203,63,95,203,39
1320 DATA 131,95,22,0,33,53,161,25
1330 DATA 68,77,225,126,230,15,95,203
1340 DATA 35,96,105,25,241,245,203,39
1350 DATA 245,78,205,52,189,241,60,35
1360 DATA 78,205,52,189,241,245,33,31
1370 DATA 160,95,22,0,25,198,8,78
1380 DATA 205,52,189,24,170,119,7,12
1390 DATA 7,167,6,71,6,237,5,152
1400 DATA 5,71,5,252,4,212,4,112
1410 DATA 4,49,4,244,3,220,3,134
1420 DATA 3,88,3,36,3,246,2,204
1430 DATA 2,164,2,126,2,90,2,56
1440 DATA 2,24,2,250,1,222,1,195
1450 DATA 1,170,1,146,1,123,1,102
1460 DATA 1,82,1,63,1,45,1,28
1470 DATA 1,12,1,253,0,239,0,225
1480 DATA 0,213,0,201,0,190,0,179
1490 DATA 0,169,0,159,0,150,0,142
1500 DATA 0,134,0,127,0,119,0,113
1510 DATA 0,106,0,100,0,95,0,89
1520 DATA 0,84,0,80,0,75,0,71
1530 DATA 0,67,0,63,0,60,0,56
1540 DATA 0,53,0,50,0,47,0,45
1550 DATA 0,42,0,40,0,38,0,36
1560 DATA 0,34,0,32,0,1,211,161
1570 DATA 33,207,161,205,209,188,201,0
1580 DATA 0,0,0,228,161,195,7,162
1590 DATA 195,77,160,195,98,162,195,106
1600 DATA 162,195,113,162,77,85,83,73
1610 DATA 67,79,206,77,85,83,73,67
1620 DATA 79,70,198,80,65,85,83,197
1630 DATA 67,79,78,84,73,78,85,197
1640 DATA 86,79,76,85,77,197,0,245
1650 DATA 221,229,205,77,160,221,225,241
1660 DATA 254,2,216,254,5,208,254,2
1670 DATA 40,65,254,3,40,54,62,3
1680 DATA 50,28,160,221,110,0,221,102
1690 DATA 1,34,26,160,221,35,221,35
1700 DATA 221,110,0,221,102,1,34,24
1710 DATA 160,221,35,221,35,221,110,0
1720 DATA 221,102,1,34,22,160,221,35
1730 DATA 221,35,221,126,0,50,29,160
1740 DATA 205,39,160,201,62,2,50,28
1750 DATA 160,24,213,62,1,50,28,160
1760 DATA 24,219,205,86,160,33,6,160
1770 DATA 205,10,189,201,175,50,8,160
1780 DATA 201,254,0,200,254,4,208,254
1790 DATA 1,40,24,254,2,40,10,221
1800 DATA 126,0,50,33,160,221,35,221
1810 DATA 35,221,126,0,50,32,160,221
1820 DATA 35,221,35,221,126,0,50,31
1830 DATA 160,201,0,0,0,0,0,0
5000 IF check() 60526  THEN PRINT"
error in data"
```

Sound



Sound Master, for the 48K ZX Spectrum, allows you to store sound or speech into the computer's memory and replay it afterwards. But it also allows you to reverse the sound, replay it at eight different speeds, and with varying echoes.

The program itself is not very large, about 4K of Basic and 2.5K of machine code, but the enormous chunk of memory used to store the speech — almost 32K for four seconds — caters for 48K users only. I will give a detailed explanation of the use of the program later. First let me tell you how to get the program in you computer in the first place.

Enter program 1, make sure everything is keyed in exactly as in the listing. Save it using

SAVE "SM" LINE 1

and start the tape recorder. Press Enter. Enter program 2. When it runs perfectly Save the machine code using

SAVE "code 1" CODE 65025,224

and verify it. This is very important. Repeat the process with program 3 and Save the machine code with

SAVE "code 2" CODE 30000, 1835.

Start the tape recorder, press record and play together, and then press enter.

Now rewind the tape to the start of the code and press

VERIFY "" CODE

Clear the computer using

RANDOMIZE USR 0

You should get a black screen, red lines and the Sinclair copyright mesage, as if you just switched the computer on. Spectrum Plus owners can do this by simply pressing the little switch on the left-hand side of the machine.

Enter the Basic listing — program 4 — starting with

1 CLEAR 29999: LET spd=7

Never attempt to Run it or to press Go To (line number) since a crash will always be the result and you would have to start all over again.

Check everything carefully, then

SAVE "BASIC" LINE 1.

and verify.

Clear the computer as described then rewind the tape and enter Load "", no spaces. Sound Master should now load normally

The first thing you see when the program has loaded is the blue menu screen. You're presented with 10 options, numbered 0-9. They are:

1. Record sound

This option allows you to enter sound via a tape recorder or microphone which is attached to the Ear socket of the Spectrum. After about four seconds, an OK message should appear on your screen and the program then returns to the menu. However, if this does not happen then you have entered a wrong hex code between adresses 65025-65052.

What this routine does is scan the Ear socket at a rate of 64,512 Hertz or, 64,512 times per second, for a noise. If it recieves a noise, a click, it stores a 1 in its memory. If it doesn't, it stores a 0. These 1s and 0s are stored in memory in groups of eight, known as bytes. The analogue sound is digitised.

2. Replay sound

This option replays the sound you stored in the computer. It is, in fact, the reverse of option 1. It converts the 1s and 0s from memory to clicks and no-clicks.

This reproduces a sound which is quite recognisable. But because of the slow speed at which actions take place, and the Spectrum's limited speaker some ambiguity is unavoidable. Fantastic, clear sound is produced at a 17 mHertz rate, while ours is produced at 64 kHertz. This is due to the speed of the Z-80 microprocessor found in the Spectrum. It is, in fact, quite a fast eight-bit processor, but for our purposes not fast enough to produce a sound that is free from disturbing noise. Using a Dolby cassette deck would help in filtering out these noises though.

If we wanted a clear, solid sound for four seconds, then we would need a computer with 256 times more memory thant the Spectrum, and which runs at least 256 times faster! Perhaps a Cray-1 will do. If you have any problems here, check your bytes between 65053 and 65085.

3. Change speed

The program allows you to replay the sound at eight different speeds. Speed 1 is superfast — you'll need mega-ears to understand any of it — and speed eight is the slowest. Speed 7 is the one at which sound is always recorded.

4. Disappearing Echo

It is impossible to do any magic with the Spectrum's sound speaker's volume under software control. So I present you with a disappearing echo instead of a fading one. Echo-steps may be controlled by the user. Echoing is done at the current speed, set at option 3. This is initially 7.

5. Appearing echo

Which is, of course, the opposite of option 4.

4. Fastening echo

This produces an echo which starts at the current speed and repeats, faster and faster, until it reaches speed 1. If, for example, the current speed is 5, then the program echoes are 5, 4, 3, 2, 1. If the current speed is 8, the speeds are 8,7,6, etc. This option has no effect whatsoever on the current speed at which sound is replayed in option 2.

7. Slowing echo

The echo starts at the current speed and slows down until it reaches speed 8. Again, this command has no effect on the current sound speed.

Listing 1.

```
   1 REM Sound Master vII/2.0
         By Roy Dictus 1985
  10 CLEAR 29999: CLS : LOAD ""C
ODE
  15 INPUT "Is your Spectrum Iss
ue 2? (A/N)";A$
  18 IF A$="Y" OR A$="y" THEN GO
 TO 120
  20 POKE 65162,190
  30 POKE 65170,189
  40 POKE 65178,187
  50 POKE 65186,183
  60 POKE 65203,175
  70 POKE 65207,175
  80 POKE 65215,183
  90 POKE 65223,187
 100 POKE 65231,189
 110 POKE 65239,190
 120 LOAD ""CODE
 130 LOAD ""
```

Listing 2.

```
   1 CLEAR 65024
   2 DEF FN a(a$)=CODE a$-48-7*(
a$>"9")-32*(a$>"Z"): DEF FN h(a$
)=FN a(a$(1))*16+FN a(a$(2))
  10 RESTORE : LET a=65025: FOR
x=100 TO 120 STEP 10
  20 READ a$: LET t=VAL a$( TO 5
): LET a$=a$(6 TO ): IF LEN a$/2
<>INT (LEN a$/2) THEN PRINT AT 1
6,0;"Length error in line ";x: S
TOP
  40 POKE a,FN h(a$): LET t=t-PE
EK a: LET a=a+1
  50 LET a$=a$(3 TO ): IF a$<>""
 THEN GO TO 40
  60 IF t THEN PRINT AT 16,0;"Er
ror in line ";x: STOP
  70 PRINT AT 16,0;"Line ";x;" O
K"
  80 NEXT x
 100 DATA "09395f32100800608dbfe
cb772002cbfecb3e10f4cb0e237cfefe
20eafbc9f32100800608cb4620043e05
d3fe3e15d3fecb0e10f0cb0e237cfefe
20e6fbc97efe00c8d72318f821005830
6077110158015f00"
 110 DATA "08182edb0c901003f2100
801100fe7ef51a77f112231b0b78b120
f32100801100 7e4e0608cb111f10fb23
1b7ab320f2c93e02cd011601fef7eo 8
fefe200401e803c9fed200401/  4c9
fefb200401b004c9"
 120 DATA "07217fef7200401140 5c9
feef2004017805c901feefed78feef20
0401dc05c9fef72004014006c9feb20
0401a406c9fefd2004010807c9fefe20
04016c07c901f401c9"
```

sampler



8. Load file

Use to Load a file previously saved using this program. You'll be asked for a filename but if you can't remember the name of the file you want to load, just press Enter. This command will only accept sound master-files.

9. Save file

When you have successfully sampled sound you may wish to Save it to tape. Enter the filename, start the tape recording and then press any key. Remember that 32,258 bytes have to be saved so saving might take as long as 2.5 minutes.

10. Reverse sound

This handy routine reverses the sound stored in the micro. This means, effectively, that if you had a recording in your memory of you saying "computer" then the reversed version would say "retupmoc". Intonation is also reversed. This produces smashing effects.

Note that this option does not produce any sound, yet swops bits and bytes around in the computer's memory. This means that every other option, except 1, now operates on reversed sound.

If you now Save your file and load it back later, you will notice that the sound is still in its reversed form. To restore it to normal, just use option 0 again. Any troubles in reversing your sound? Check your bytes 65108-65150.

Trouble with the main menu screen has to do with wrong coding in locations 30000-300014. If you spot trouble, again check your hex codes.

For the technically-minded; speech is stored between adresses 32768 and 65024. Using the following routine, which I did not include in the main program, you can Invert the sound, that is, high sounds become low sounds and vice versa:

```
LD HL,32768         LD A,H
L1 LD A,(HL)        CP 254
CPL                 JR NZ, L1
LD (HL), A          RET
INC HL
```

The program has been tested on Spectrum + and Spectrum issues 2 and 3. Program 1 includes the pokes necessary to adapt the program to run on Spectrum + and Spectrum issue 3.

If you would like a copy of Sound Master but find it rather tedious to key in the listings and machine code, simply send £2 to: Sound Master Offer, Roy Dictus, Apostelster. 8,2000 Antwerp, Belgium. You will recieve a copy of the program in your postbox.

Listing 3.

```
   1 CLEAR 29999
   2 DEF FN a(a$)=CODE a$-48-7*(
a$>"9")-32*(a$>"Z"): DEF FN h(a$
)=FN a(a$(1))*16+FN a(a$(2))
  10 RESTORE : LET a=30000: FOR
x=100 TO 320 STEP 10
  20 READ a$: LET t=VAL a$( TO 5
): LET a$=a$(6 TO ): IF LEN a$/2
<>INT (LEN a$/2) THEN PRINT AT 1
6,0;"Length error in line ";x: S
TOP
  40 POKE a,FN h(a$): LET t=t-PE
EK a: LET a=a+1
  50 LET a$=a$(3 TO ): IF a$<>""
 THEN GO TO 40
  60 IF t THEN PRINT AT 16,0;"Er
ror in line ";x: STOP
  70 PRINT AT 16,0;"Line ";x;" O
k"
  80 NEXT x
 100 DATA "06078c33b757efe00c8d7
2318f8af323c5c2100583e4f77110158
015f00edb02154 75cd3375c916010113
01160101534f554e44204d4153544552
2052443635205 34f554e44204d415354
4552160305 5b315d"
 110 DATA "0490420524543 4f524420
534f554e4416050 55b325d205245504c
415920534f554e4416070 55b335d2043
48414e474520535045454416090 55b34
5d2044495341 5050454152494e472045
43484f160b055b35"
 120 DATA "049125d204150504541 52
494e4720454348 4f160d055b365d2046
415354454e494e4720454348 4f160f05
5b375d20534c4f57494e4720454348 4f
1611055b385d204c4f41442046494c45
1613055b395d2053"
 130 DATA "083374156452046494c45
1615055b305d205245564552534520 53
4f554e4400af323c5ccd45fe21c976cd
3375c9af323c5ccd45fe217977cd3375
c9af323c5ccd45fe21f377cd3375c9af
323c5ccd45fe217d"
 140 DATA "1017878cd3375c9af323c
5ccd45fe21ec78cd3375c9af323c5ccd
45fe215579cd3375c9af323c5ccd45fe
21bf79cd3375c9af323c5ccd45fe2125
7acd3375c9af323c5ccd45fe21bb7acd
3375c9af323c5ccd"
 150 DATA "0615745fe21537bcd3375
c913011601035245434f52442053 4f55
4e44202d2d204f5054494f4e20311604
01576520617265206 76f696e6720746f
2073746f726520736f756e6420696e16
06017468652063 6f"
 160 DATA "067416d70757465722773
206d656d6f72792e20204d616b651608
01737572652074686520636 1626c6573
20617265206 26f74682063 6f6e2d160a
016e65637465642074 6f204541522c20
73746172742074 61"
 170 DATA "0587870652074686 56e16
0c0170726573732061 6e79206b65792e
0013011601045245504c415920534f55
4e44202d2d204f5054494f4e20321604
015265706c617920736f756e6420 7374
6f726564 20696e20"
 180 DATA "06016636f6d70752d1606
017465722e20205468652063 75727265
6e7420737065656420697320202e1608
015072657373206 16e79206b65792077
68656e20726 56164792e001301160104
4348414e474520 53"
 190 DATA "059015045454 4202d2d20
4f5054494f4e20331604015468652063
757272656e742073706565642069 7320
202e160601537065656473206d757374
206265206 96e207468652072616e6765
1608015b31202866"
 200 DATA "0544261737465737 42920
2d2038202873 6c6f77657374295d2e16
0a014e6f726d616c207370656564 2069
7320372e001301160102444953415050
454152494e4720454348 4f202d204f50
54494f4e20341604"
 210 DATA "0643701446973617 07065
6172696e6720656368 6f20617420 6375
7272656e741606017370656564 207768
6963682069732 0202e160c0150726573
7320616e79206b6579207 46f20737461
72742e0013011601"
 220 DATA "059060341505045415249
4e4720454348 4f202d204f5054494f4e
20351604014170706561726 96e672065
63686f2061742 063757272656e741606
017370656564 2077686963682069 7320
202e160c01507265"
 230 DATA "06044737320616e79206b
6579207 46f207374617274 2e00130116
0103464153544 54e494e47204543484f
202d2d204f5054494f4e203616040146
617374656e696e6720656368 6f206174
2063757272656e74"
 240 DATA "0540016060173 70656564
2077686963682069 7320202e16100150
72657373 20616e79206b657920746f20
73746172742e00130116010453 4c4f57
494e4720454348 4f202d2d204f505449
4f4e20371604 0153"
 250 DATA "062526c6f77696e672065
63686f2061742063757272656e741606
0173706565642077686963682069 7320
202e16100150726573732061 6e79206b
6579207 46f2073746172742e00130116
01054c4f41442046"
 260 DATA "05852494c45202d2d2d20
4f5054494f4e2038160601 4c4f414420
66696c6520287 36f756e64292e160801
52656d656d626572204920 77696c6c20
6f6e6c79204c4f4144160a0174686520
636f727265637420"
 270 DATA "0586053 4d2066696c6573
2e160c014c6f6164696e6720746 96d65
206c6974746c65206c6f6e676572160e
017468616e20332e35206d696e757465
732e001301160105534156452046494c
45202d2d2d204f50"
 280 DATA "0630654494f4e20391606
015341564520666 96c652e1608015468
6520736f756e64206d656d6f72792077
696c6c206e6f7720626 5160a01736176
656420666f72206c617465722075736 5
2e20202049742061"
 290 DATA "057156b6573160c01616c
6d6f7374203332 4b3a20736176696e67
2074696d6520616 26f7574160e01332e
35206d696e757465732e001301160103
5245564552534520534f554e44202d2d
2d204f5054494f4e"
 300 DATA "0667720301606015 76520
77696c6c20726576657273652074686 5
20736f756e64160801737 46f72656420
696e206d656d6f72792e2020416c6c20
736f756e64160a0177696c6c206672 6f
6d206e6f77206f6e"
 310 DATA "0677120626520706c6179
656420696e160c017265766572736 52e
20205468697320636 16e2067697665 20
616d617a696e67160e01656666656374
732e2020546865207 26f7574696e6520
69732073656c662d"
 320 DATA "0639116100169 6e766572
74696e673a20746869732 06d65616e73
2062792075736 96e6716120169742074
77696365 2c20746865 20736f756e6420
77696c6c206265 516140 16e6f726d616c
206167"
```

Listing 4

```
   1 CLEAR 29999: LET spd=7
  10 PAPER 5: BORDER 5: INK 0: B
RIGHT 1: CLS : RANDOMIZE USR 300
00: BEEP .01,20
 500 LET a=USR 65151: GO TO a
1000 CLS : RANDOMIZE USR 30269
1001 GO SUB 9000
1002 RANDOMIZE USR 65025: PRINT
AT 14,14;" OK ": BEEP 1,30: CLS
 : GO TO 10
1100 CLS : RANDOMIZE USR 30283
1101 PRINT AT 6,28;spd: GO SUB 9
000
1102 POKE 65058,spd: RANDOMIZE U
SR 65053: PAUSE 10: GO TO 10
1200 CLS : RANDOMIZE USR 30297:
PRINT AT 4,22;spd
1201 INPUT "Speed ? [1-8]"+CHR$
6+">";spd: IF spd>8 OR spd<1 THE
N GO TO 1201
1202 PRINT AT 4,22;spd: BEEP 1,3
0: GO TO 10
1300 CLS : RANDOMIZE USR 30311:
GO SUB 9010: GO SUB 9000
1301 INPUT "Steps ? >";steps: LE
T x=INT (125/steps): FOR a=128 T
O 253 STEP x: POKE 65056,a: RAND
OMIZE USR 65053: NEXT a
1302 GO TO 10
1400 CLS : RANDOMIZE USR 30325:
GO SUB 9010: GO SUB 9000
1401 INPUT "Steps ? >";steps: LE
T x=INT (125/steps): FOR a=253 T
O 128 STEP -x: POKE 65056,a: RAN
DOMIZE USR 65053: NEXT a
1402 GO TO 10
1403 INPUT "Steps ? >";steps: LE
T x=INT (125/steps): FOR a=128 T
O 253 STEP x: POKE 65056,a: RAND
OMIZE USR 65053: NEXT a: POKE 65
056,128
1500 CLS : RANDOMIZE USR 30339:
GO SUB 9010: GO SUB 9000: FOR t=
spd TO 1 STEP -1: POKE 65058,t:
RANDOMIZE USR 65053: NEXT t: GO
TO 10
1600 CLS : RANDOMIZE USR 30353:
GO SUB 9010: GO SUB 9000: FOR t=
1 TO spd: POKE 65058,t: RANDOMIZ
E USR 65053: NEXT t: GO TO 10
1700 CLS : RANDOMIZE USR 30367
1701 INPUT "Filename ? >"; LINE
a$: IF LEN a$>10 THEN GO TO 1701
1702 LOAD a$CODE 32768,32256: GO
 TO 10
1800 CLS : RANDOMIZE USR 30381:
GO SUB 9000
1801 INPUT "Filename ?  >"; LINE
 a$: IF a$="" OR LEN a$>10 THEN
GO TO 1801
1802 SAVE a$CODE 32768,32256
1803 INPUT "Verify ? (y/n) >"; L
INE b$: IF b$(1)="y" OR b$(1)="Y
" THEN VERIFY a$CODE 32768,32256
1804 GO TO 10
1900 CLS : RANDOMIZE USR 30395:
RANDOMIZE USR 65108: PRINT AT 21
,0; PAPER 2; INK 7; BRIGHT 1; FL
ASH 1;"Any key": GO SUB 9000: PR
INT AT 21,0;"Sound reversed.": B
EEP 1,30: BEEP 1,32: GO TO 10
8999 STOP
9000 IF INKEY$="" THEN GO TO 900
0
9001 RETURN
9010 PRINT AT 6,16;spd: RETURN
```

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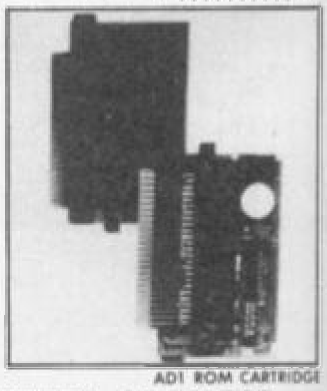
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COMPETITION Transformers



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- The names of the winners will be printed in the February issue of *Your Computer*.
- All entries must arrive at the *Your Computer* offices by the last working day in December 1985.
- Each person may enter the competition only once.
- Entries to the competition cannot be acknowledged.
- No employees of Business Press International or their relatives may enter the competition.
- The decision of the editor is final.
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16 Transformer Dinobots worth £20 each. We need to find homes for four Grimlocks, four Snails, four Sludges and four Slags. These Dinobots can be flipped from robots into prehistoric monsters to "defend Earth's primaeval outer fringes from the Evil Deception." We're also giving away 50 Spectrum and 50 CBM-64 copies of Ocean's new Transformer game.

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Rocketman

If you enjoyed Mad Caverns you'll go bananas over Rocket Man Mike — another commercial quality game from Karl Jeffery, the author of one of 1984's charttoppers, Mutant Monty.

Guide Mike around 10 screens collecting the amulets. Moving to the top of the screen takes you to the bottom of the next, so learning the geography of the place is easy.

To enter the game type in and save listings 1 and 2. On the other side of your tape save:

```
10 CLEAR 32667: LOAD ""
   CODE 32668: PRINT USR
   39202
```

Save it with:

```
SAVE "ROCKET" LINE 10
```

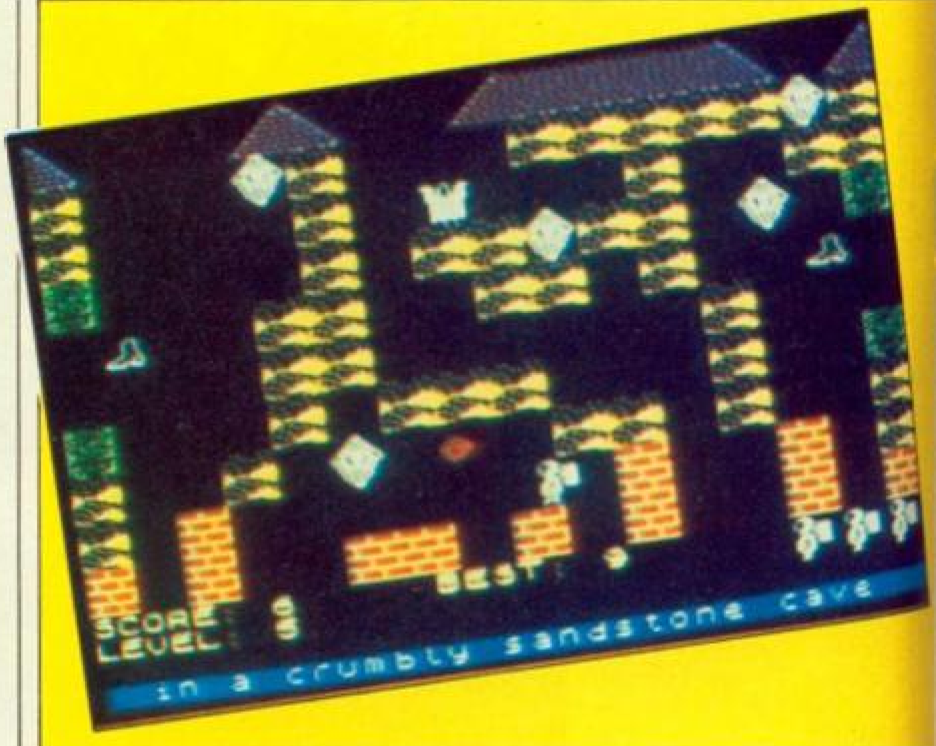
Now load and run listing 1. When it has finished Poking the machine code into memory, load and run listing 2, which Pokes the second part of the code. You can then save the blocks of code together, after the loader program, by typing:

```
SAVE "code" CODE 50000,
  8500
```

The controls for the game are as follows:

Z,C,B,M,Space	Right
Caps,X,V,N, Symbol Shift	Left
Q,W,E,R,T,Y,I,O,P	Thrust up
A,S,D,F,G,H,J,K,L	Hover/Stop
1	Pause
Caps and Space	Quit the game

A 15-screen version of the game, with extra music, is available for £3.50, while a full source code listing is available for £1.50. Write to Karl Jeffery, 27 Testcombe Road, Alverstoke, Gosport, Hampshire PO12 2EL.

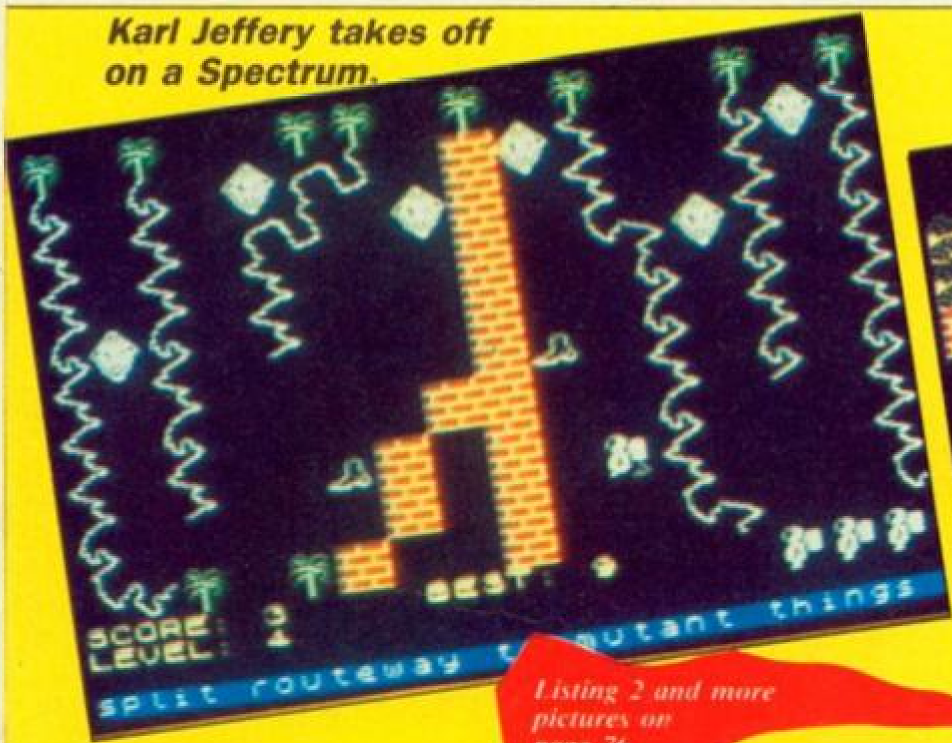


Listing 1.

```
   1 REM rocket data 1
   2 CLEAR 49999
   5 DEF FN a(a$)=CODE a$-48-7*(
a$>"9")-32*(a$>"Z"): DEF FN h(a$
)=FN a(a$(1))*16+FN a(a$(2))
  10 LET a=50000: FOR x=100 TO 5
90 STEP 10
  20 READ a$: LET t=VAL a$( TO 5
): LET a$=a$(6 TO ): IF LEN a$/2
<>INT (LEN a$/2) THEN PRINT AT 1
6,0:"Length error in line ";x: S
TOP
  40 POKE a,FN h(a$): LET t=t-PE
EK a: LET a=a+1
  50 LET a$=a$(3 TO ): IF a$<>""
 THEN GO TO 40
  60 IF t THEN PRINT AT 16,0;"Er
ror in line ";x: STOP
  70 PRINT AT 16,0:"Line ";x;" O
K"
  80 NEXT x
 100 DATA "0173807070707070707070707
070707070707070707070732030303450404
4406054342470707070707040404040707
07074343434342424242020642460505
050502024202070707070703030303 0506
0506474747470707"
 110 DATA "019920707030303030607
060744444444407070707070700000000000
000000000000000000000000000000000000
000000000000000000000000000001e2727
2f1e0c1f3b3b3b371e0c1c00000000000078
78f8f878787800000"
 120 DATA "03936000000000000001e2727
2f1e0c1f3b3b373f161a3600000000000078
78f8f8787878000000000000000000001e2727
2f1e0c1f3b3b333f1e300000000000000078
78f8f87878780028204824000001e2727
2f1e0c1f3b3b333f"
 130 DATA "062581e30000000000000078
78f8f8787878001008245000000000001e
1e1f1f1e1e1e00000000000000000078e4e4
f47830f8dcdcdcec78303800000000000001e
1e1f1f1e1e1e00000000000000000078e4e4
f47830f8dcdcecfc"
 140 DATA "0598468586c0000000000001e
1e1f1f1e1e1e001404122400000078e4e4
f47830f8dcdcccfc780c000000000000001e
1e1f1f1e1e1e000810240a00000078e4e4
f47830f8dcdcccfc780c0000000000000070
58c8081830203018"
 150 DATA "031570c060300000000000000
00030e08e8b880c040c08000000000000000
0101c16121331a0a0e0c000000040e0a0
a020311312121a0a0e060000021e3018
0f01000000000000000000000003000000000
00e038704060301e"
 160 DATA "03500033ee080003040c08
0818101c0406030000000030600000000000
0000e0b0909c860c38e080000006040406
03018080c04040612f380000000000000000
00808080c04040c00000000000003010101
01010000000000000000"
 170 DATA "022790000000000000000000
0008081c764341c000000000000000000000
000107040c080c06020203010000000000c
3fe301010000000000000000080000000000
80e03c07000000001070c040600000000000
00000080c07030e0"
 180 DATA "0899200000000000fefefe00
efefef00fefefe00efefef00fefefe00
efefef00fefefe00dfdfdf00000000000000
00000000003030c0e302de0b603020e0b
3036c0db00b600db00b600dbc0c07050
0cdc036d00db006d"
 190 DATA "0754100db006d0000000000
000000000c04030b00c6403b700db006d
00ed006d00db006e00db006d006e00db
00b600b7007600db00b600b7a599a5c3
a599a5c3a599a5c3a599a5c3864a324a
864a324a864a324a"
 200 DATA "08917864a324ae5d5f0c4
b1c4b5c6c5f0e4c091f5d0b415471b55
15eb47455b8b2f11435b075f00fffffb
bffdb7a94a54a2448025800200fff7ff
bfed562d4495480288000a04000e110d
16021f20070d1101"
 210 DATA "0870001010101000007844
80b8c4f0888890808080808014004108
8024c0eff0c29004a20983e812004801
0c7ffffff7f0fa1087dfeff0fff1029c6
c62910ff844a31314a84ff00ff844a31
314a84ff21528c8c"
 220 DATA "096625221ff00235da255
4955a2dddda2554955a25d23c4ba45aa
92aa45bbbb45aa92aa45bac4c08f3f32
737b6c6e737b6c6e333f8fc003f1fcac
36bec6ee36bec6e63cfcf10303040a15
2d5b8bb3582b2d15"
 230 DATA "08248150a04038040a050
68b4a29a34a8685050a040808a8adada
daaaaaaa8a8a8a8a8a8a8a8a97979494
a4a4a4c6c6a4a4a49494979700003828
380404060207060703030000000000e0a0
e010101808fc4c1c"
 240 DATA "02479f8180000000001c14
1c040406020706070302000000000000000
3828380808fc0cbcf808000000000000e0a
0e040404040f0c0f070600000000003828
3810101010f818f8f03000000000000001
030307070f0f0f0f"
 250 DATA "036950701000000000000
8080c04060a0a060c000000000000000000
000001070f0f0f0603000000000000000
0070f0f0a0a040c080000000000000001
030307070f0f0f0f0701000000000000000
8080c04060a0a060"
 260 DATA "03295c000000000000000
000e0f0e070703030100000000000000000
00008060b0d0f0e0c000000000000000000
06130c2b17170b0c030000000000000080
b0e418ea7474e818e0000000000000000000
0005160933130906"
 270 DATA "02873010000000000000000
80d034c86664c830c0000000000000000000
00000516090b0906010000000000000000
0000d034c868c830c00000000000000000
000001060906010000000000000000000
0000c0304830c000"
 280 DATA "02443000000000001030301
000001020003040404020c0010b8b810
a044f840c0301808080418000000060f06
0000010200030402060000000010383890
6040f84040b0101808081000000060f06
0000030007050c00"
 290 DATA "039190000000060f06888
7040f84040b0103020204000000e0702
00000102000102020204000e0702888
7044f84040b0103020204000000000000
10180e090d0b0904020000000000000000
08187090b0d09020"
 300 DATA "02144000000000000000
10080e090d0b0904040000000000000000
08107090b0d0902020000000000000000
08080e0d0d0b090a10000000000000000
101070b0b0d0905000000000000000000
04080e0d0d0b090a"
 310 DATA "036080a000000000000000
201070b0b0d09050500000000000000208
0d253516150a0b04070000000000002010
5050d07090d020c0000000000000000001
0d253516140a0b040700000000000000008
10d0d070c8689860"
 320 DATA "031928000000000000000
051535252b140d0a08070000000000000090
20e488e818d030c08080000000000000001
0105151517160d0b0d070000000000000000
2028684858f050a040800000000000000307
0d2926170a121020"
 330 DATA "04239202000000000080c0
```

Mike

Karl Jeffery takes off on a Spectrum.



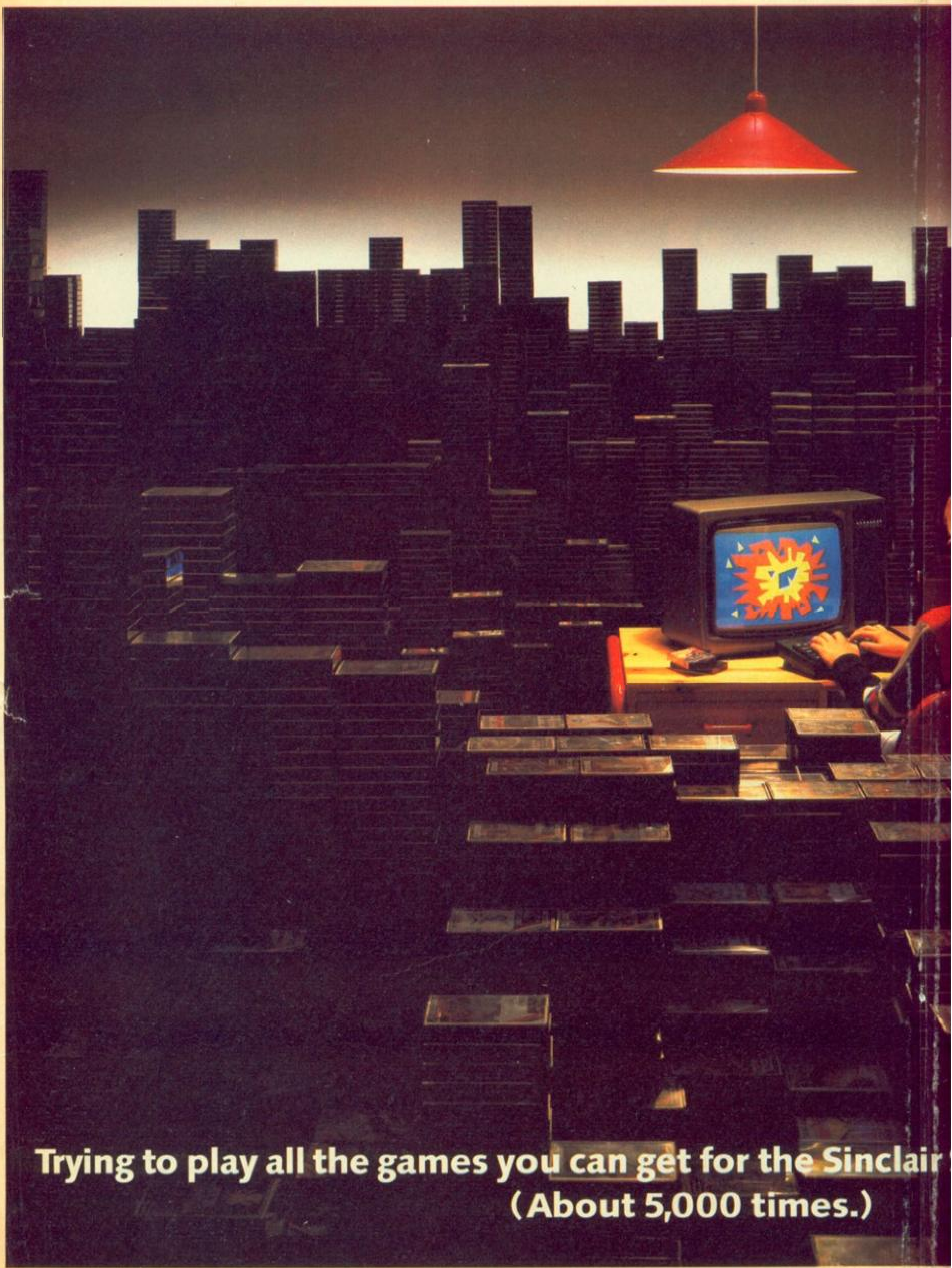
Listing 2 and more pictures on page 76

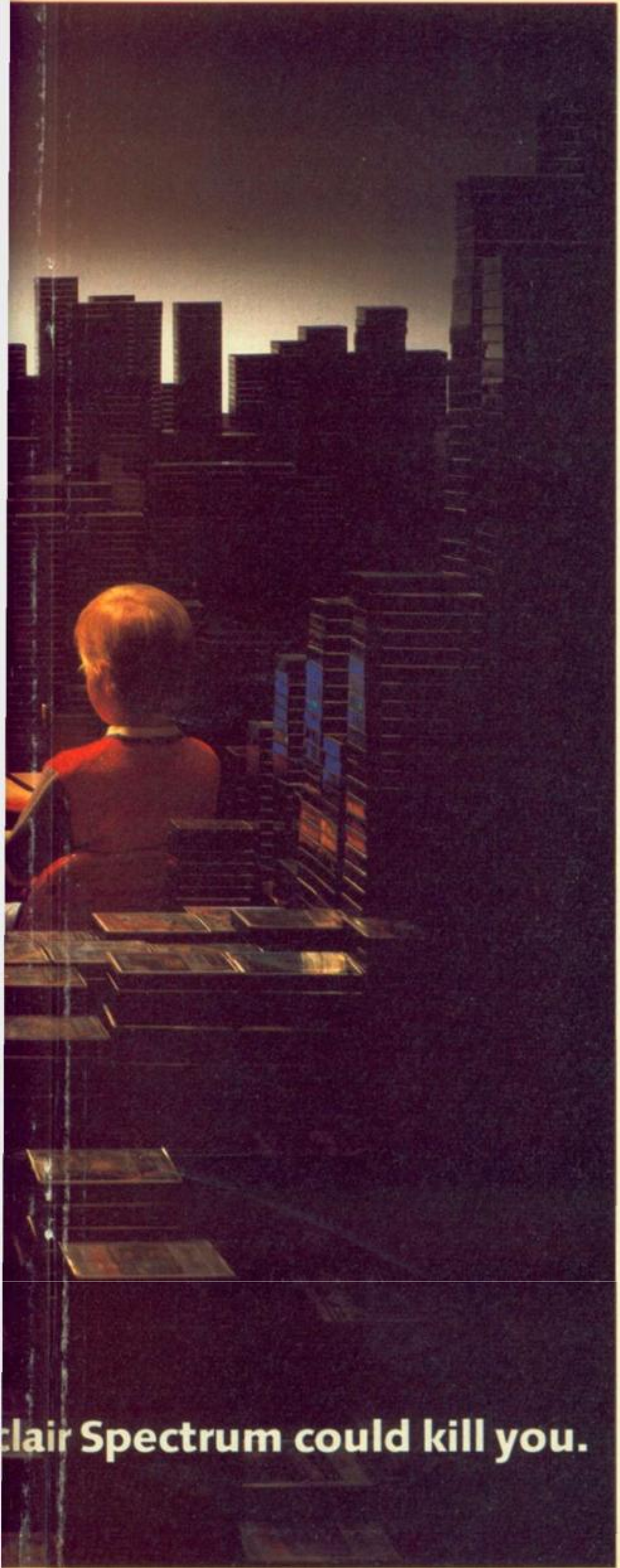




This program is available on the Telsoft service.

```
6028c8d0a09010080808000000000107
0d0926170a12102010000000000080c0
6020c8d0a09010081000000000000207
0d0906370a12102010000000000080c0
6020c0d8a09010e0"
 340 DATA "0272900000000000000307
0d2926170a12100e00000000000000c0
6028c8d0a09010081000000000000003
0307050f0e0607030300000000000000
80c060e0c0c080800000000000000000
03070d1f1e0e0f07"
 350 DATA "0570003000000000000000
80e070f8f8f0e0c00000000000000001
070f193f3e1e0f070000000000000000
c0e020e0e0e0c080000000000000030f
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f0f038f8f8f8f0e0"
 360 DATA "02218c0800000000000000
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0101010638613f000000000000a05010
1010082814e438000000000000000000
0101010101063861"
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 380 DATA "065263cfcf000000071f1f
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3c38190f0f0e1f181f0f030000e0f8fc
9e8ecc787838fc0c7cf8e00000071f1f
3838190f0e1e3f38"
 390 DATA "072851e1f070000f0fcfc
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ecfe00fe9200fe6cb8e0000000000000
00300e013f3f3f1f"
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787818d858c0b87ceccc840000000000
00300e013f3f3f1f1f0f070000787878
787818d858c0b87c"
 420 DATA "06613eccc8400000000010
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787818d858c0b87ceccc84000030797a
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3a3a3e3f1f1f1f1f"
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5e5e7efcfcfcf8f8"
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2d1a101d2f040603"
 450 DATA "051250100000000000c0f0
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0d38123d0f040603010000000000c0f0
da8ca45cfa903060c080000000000010
3938100000000081c0800000001c0880
c0000246e2e04000"
 460 DATA "02300000040e0000206024
0e0e040020020700103810000000081c
08000400010383810028602000071238
38100206227020040e24700000100440
644e04200024707020040c0000440018
3c19000210393913"
 470 DATA "048420148610000040e440
4016020220048cc0803012000000030f
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0f177f7d1f070810000000000000002f2
da7cdc7cf8e01020"
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0000150000001500"
 520 DATA "010891c1c630c0f0d1100
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0000000000000000631c000c0b001100
00171717000000001c00000c0c000000
12141717170000001c1c000b0b000012
6300000017171717"
 530 DATA "023931c1c000b0b001214
14141300000017171700000c0c000000
00000000000000000000000b0e090a0a
0a090a0909090a090a090a0d00000510
2f6002002ee02f60000152908f3000ff
52309f3000ff3e30"
 540 DATA "036059f3000ff3e0000000
00000000000000000000000000000000
00000000000000000000000020746865
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696e6b79206b6f6e6729202017171717
0017171717171700"
 550 DATA "0099700171717000000000
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1a15001a150000001213000000000000
00150063150000121414130000001515
631500151500121414141400001a1a1a
1a1a1a1a1a001100"
 560 DATA "0132300000110000000000
000000000000110063001100001a1a1a
1a1a631a1a1a11000000110000000000
0000000000001100000000001a1a1a1a
1a1a1a1a000f0a090a0a090a000005d0
2f30000132102f70"
 570 DATA "04200010032904f80ff00
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00000000000000000000000000000000
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207065617264726f"
 580 DATA "011037073202000191900
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00000016000000000000001419630000
00000016000000000000121411111100
001a1a16001b1b000012141400001111
000000160000000000"
 590 DATA "0095200000000000006311
0000001600001b001600000000001111
0000001600001b00016630000111100
001a1a16000000000000160011110000
0000001663001b000000001611171717
0017171617171b00"
```


Trying to play all the games you can get for the Sinclair
(About 5,000 times.)



How would you like to be blasted out of the sky by anti-aircraft guns?

Or perhaps you'd prefer to be vapourised by a Thargoid starship.

Or eaten for breakfast by mutant rats.

Well, you have all this and more to look forward to, if you get a Sinclair Spectrum+.

Because there are more games available for the Spectrum+ than any other home computer.

(About 5,000 the last time we counted.)

Not all of which lead to such sticky ends, we might add.

You may, for instance, rather battle it out on the chess board with a Russian grand master. Or cross swords with Nick Faldo on the golf course.

You won't just have the pick of the current titles either.

You'll get first shot at the new ones too. Because most of them become available for the Spectrum+ before anything else.

And because there are so many other Spectrum owners there are more books and magazines and clubs to join.

So if you get a Spectrum+, you may well end up in a Grand Prix pile-up.

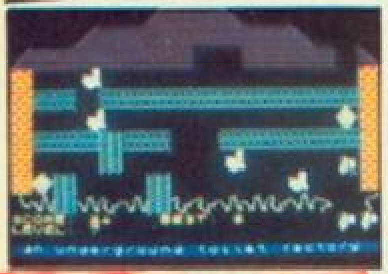
And your chances of being killed by Gremlins are very high.

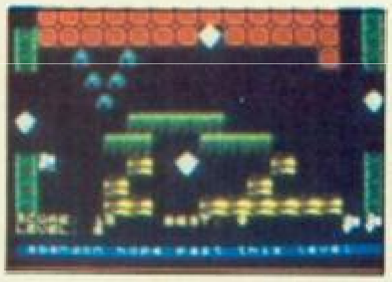
But you'll never die of boredom.

sinclair

Rocketman Mike







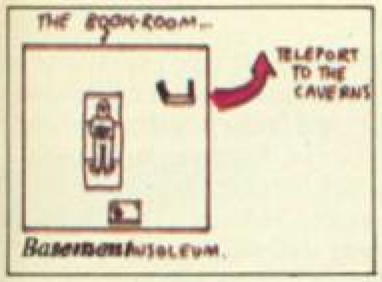
Listing 2.

```
   1 REM rocket 2
   2 DEF FN a(a$)=CODE a$-48-7*(
a$>"9")-32*(a$>"Z"): DEF FN h(a$
)=FN a(a$(1))*16+FN a(a$(2))
  10 LET a=54001: FOR x=100 TO 6
60 STEP 10
  20 READ a$: LET t=VAL a$( TO 5
): LET a$=a$(6 TO ): IF LEN a$/2
<>INT (LEN a$/2) THEN PRINT AT 1
6,0;"Length error in line ";x: S
TOP
  40 POKE a,FN h(a$): LET t=t-PE
EK a: LET a=a+1
  50 LET a$=a$(3 TO ): IF a$<>""
 THEN GO TO 40
  60 IF t THEN PRINT AT 16,0;"Er
ror in line ";x: STOP
  70 PRINT AT 16,0;"Line ";x;" O
K"
  80 NEXT x: PRINT AT 16,0;"All
OK": REM Now save the code with
SAVE "CODE" CODE 50000,8500
 100 DATA "04324171716000005409f
7000ff22f06f60ff0022007f4000ff22
902f3e00013a807f4000ff2200000000
00000000000000000000000000000000
000000000000000000000073706c6974
20726f7574657761"
 110 DATA "027657920746f206d7574
616e74207468696e6773201000100000
181000180001800001800100c000c0063
0f0d0011630b00000c630b0b000b000f
0d006311000b00000b000c0b000b000b
00000011000e1063"
 120 DATA "005100b000c0c630c000b
0000001100000c000c000b0b000b0000
0000001100000c000b000b0b000c0000
0000111100000b000c000c0b000b0000
00110011000000c0000000b0c0000000
00110011000000b00"
 130 DATA "0266100000b0e09180018
1100001100000e100000e0000005906f
5000ff3e906f5000ff3e906f5000ff3e
502f5000013e502f5000013e00000000
00000000000000000000000000000000
0000000000000000"
 140 DATA "034200000002020696e20
61206372756d626c792073616e647374
6f6e6520636176652020201300000012
13000012141414141300121900000063
19000000191919191963191900000000
190000000000001900"
 150 DATA "010100019191600000000
19001919631919006300160000000019
19000019190019000000000000000019
19000000000000190000001600000019
00191919000000190000161900001900
6300000019190019"
 160 DATA "025050000191900110000
00000000001100001100191100110000
1111001100110000110011000005107f
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608f4001004e608f4001004e00000000
0000000000000000"
 170 DATA "036380000000000000000
0000000000000000000000206162616e
646f6e20686f70652070617374207468
6973206c6576656c202020001c1c1c1c
1c1c1c1c1c1c1c1c1c0016161c1c1c1c
1c1c1c631c1c1c1c"
 180 DATA "005271c00161600000000
000000000000000001c0016000000000
00000000000000000000000000000000
00000000000000000000006363000000
17171717000000000000000000000017
170000171717170000"
 190 DATA "021430000000160000000
19006300000019000000161600000019
00000000001900000000161600000019
1900001919191919190016000005100f
90010036187f90010036206f90010036
207f90010036300f"
 200 DATA "041719001003600000000
00000000000000000000000000000000
000000000000000000000020616e2075
6e64657267726f756e6420746f696c65
7420666163746f727920206262626262
6212141413626262"
 210 DATA "015636200626262621214
14141414141414136200621214141414
14141400001414141400131100000000
0000000000000000000011111a1a001a
1a1a1a1a1a1a1a1a1a1a111100000000
0000000000000000"
 220 DATA "01803006311111a1a1a15
1a1a00001a1a1a1a1a1a111100000015
00000000000000000000111163150000
00150000000000000000110e0a150a09
0a1509090a0a090a10000f000005d02f
50ff004a803f4001"
 230 DATA "03881004a105f6002004a
207fb801004a207fb801004a00000000
00000000000000000000000000000000
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65726e206f66206861756e74696e6720
7370697269747320"
 240 DATA "010062020200000000000
15001c1c1c1c00001c1c1c001b1b0000
150000006315000000631c1b00001b1b
1a001a1a1a1a1a001a1a1c000000001b
0000000000000000000000000000001b
0000000000000000"
 250 DATA "012430000001b0000001b
1a1a1a1a00001a1a1a1a1c1b0000001b
000000160000160000001c1b0000631b
001600160000160016001c1b00001b1b
631600000000000016001c001b1b001c
1c1c1c1c1c1c1c1c"
 260 DATA "031551c001c000005507f
8801004e506f8001004e208f6000ff4e
702f5001004e702f5001004e00000000
00000000000000000000000000000000
00000000000000000000002020202074
686520696e766973"
 270 DATA "0500669626c65206d6567
61206d617a6520202020206262626262
62626262626200626262620000000062
00000000006200006300006263620062
00636200006200006262626262620000
62620000062626200"
 280 DATA "035310000000000000000
00000062626300626262626262006262
00620062006200000000062620000062
00000062006362000006262626262000
62626262006200620062626263000000
000062000000000000"
 290 DATA "027670000626262626262
6200626262626200006262620005504f
20010056504f20010056504f20010056
504f20010056504f2001005600000000
00000000000000000000000000000000
0000000000000000"
 300 DATA "034960000002020746865
206261636f6e2070726f63657373696e
6720706c616e74202020200000000000
12141414130000620062000000001214
14141414141413620062000000120000
0015000000001413"
 310 DATA "012331111110000140015
00150015000014141d00110000110015
0063001500001a1a1a00111111110000
1a1a1a151a0015631500111100000000
000063150000000015001111001a1a1a
1a1a1a001a1a1a00"
 320 DATA "026110000111100000000
00000000000000150000111a1a1a1a1a
1a1a1a1a1a1a001a1a1a1a000005102f
9001005a604f50ff005aa08f4000ff5a
008f2001015a008f2001015a00000000
0000000000000000"
 330 DATA "027300000000000000000
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06140011051900c403220058034e0011
051900ff03200058"
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0345006a06140011051900c403220058
034e00110519002603290058032700c4
0345007a023400a1"
 350 DATA "034570231007a023400a1
0231007a02340058032700f7022b0026
032900c40345006a06140011051900c4
03220058034e0011051900ff03200058
032700260353007a023400a10231007a
023400a10231007a"
 360 DATA "0306602340058032700f7
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051900c403220058034e001105190026
03290058032700c40345005803270026
03290026032900cb022e007a0260003e
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041b007a023400cb022e002603530011
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0234007a023400a10231007a023400a1
0231007a023400cb"
 380 DATA "03651022e007a023400cb
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0231007a02340058032700f7022b0026
032900c40345006a06140011051900c4
03220058034e0011"
 390 DATA "03485051900ff03200058
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051900c403220058034e00c7041b0058
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6d9f06770e903e1d"
 420 DATA "05206cd6d9fcd8c9f1301
10071102160e0020454e54455220544f
20504c415920524f434b4554204d414e
204d494b452e20130011001615001004
636f7079726967687420313938352c20
6279206b61726c20"
 430 DATA "099056a6566666572792e
1007ffdd218096dd6e00dd23dd6600dd
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e5cdb503dde101febfed78cb47280adb
1fcb6f20d2cb6728ceed4b69a03a61a0
b820043a60a0b930"
 440 DATA "0699404ed4360a0af3265
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c110ee21a08c160060f3e1dc506a0be
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77047e23dd77027e"
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cb4b2004fe1f2811"
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cb3fcb3fcb3fe60183cd6d9fdd2176a0
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dd8603dd77034f7c"
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cd39a03a62a0cb7f3a63a0c2d89bed44
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03211405111400cdb503c1c926005469
cb3dcb3dcb3dcb3d"
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4b45204841532045"
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7ee1292929292911"
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78d60747cd11a079c6074fcd11a078c6
0747cd11a078c60847cd11a0c13e1032
38a0561e00c5e53e"
 630 DATA "09969af9047a71f371fa7
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c123053a38a03d20b6d1c1c9c5e5d5cb
38cb38cb383e1590"
 640 DATA "0629526006f2929292929
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 650 DATA "036620000000000000000
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30000966045343524e04444546420130
00009670553434f524504444546570130
00009680441434e54"
 660 DATA "006560444454642013000
09690541464c0000000000000"
```

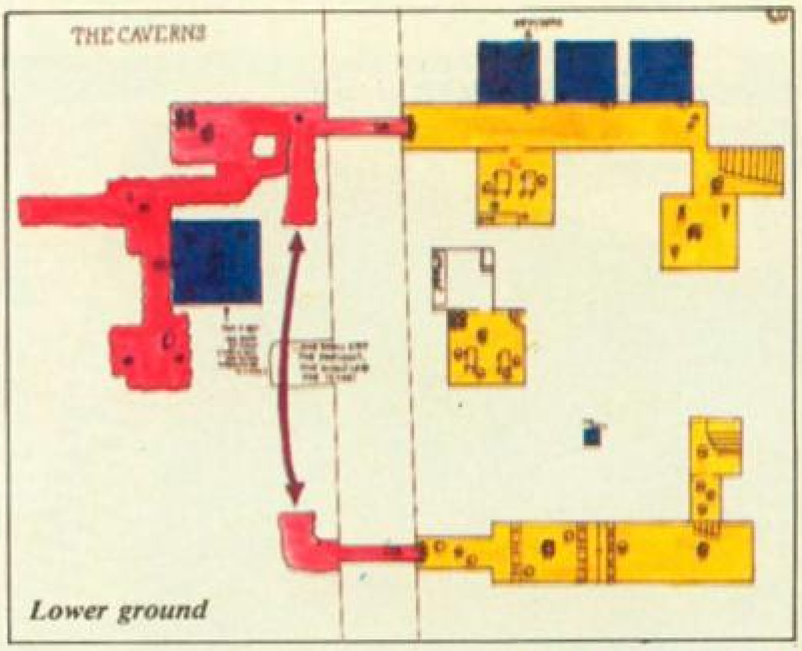
Hot Shots

MAP OF FAIRLIGHT

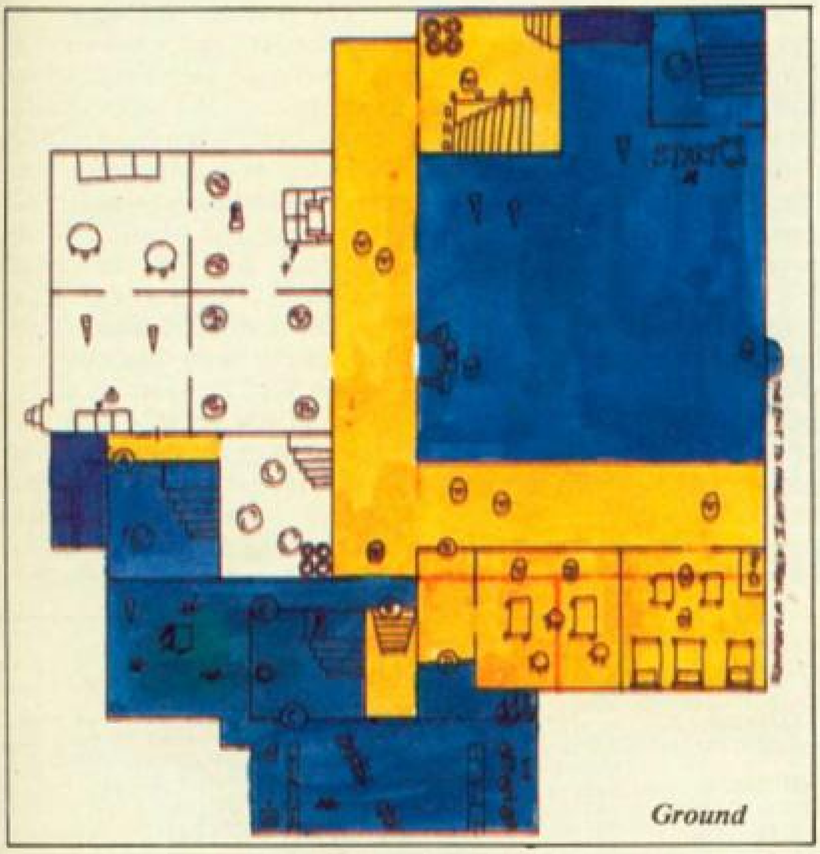
by Mischa Welsh and Stephen Hill



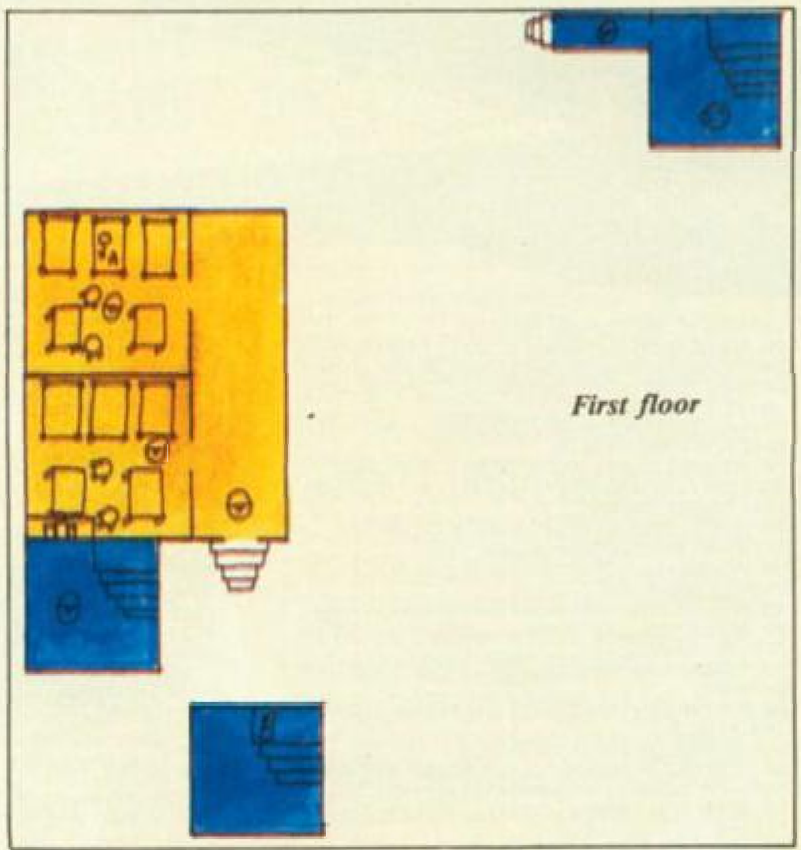
Basement



Lower ground

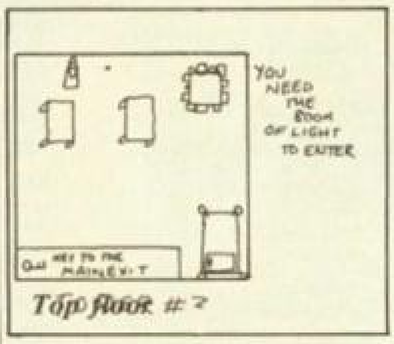


Ground

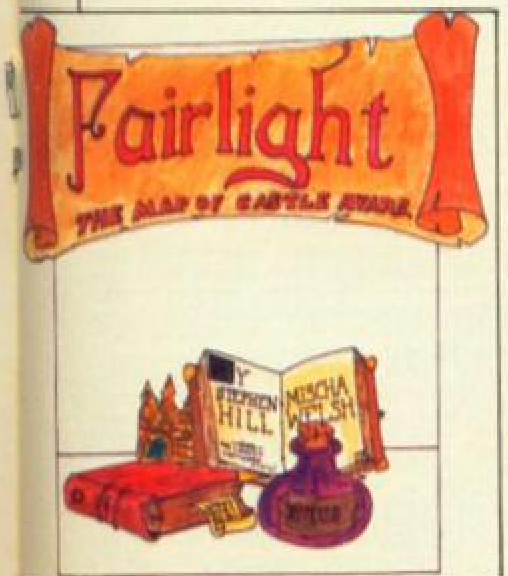


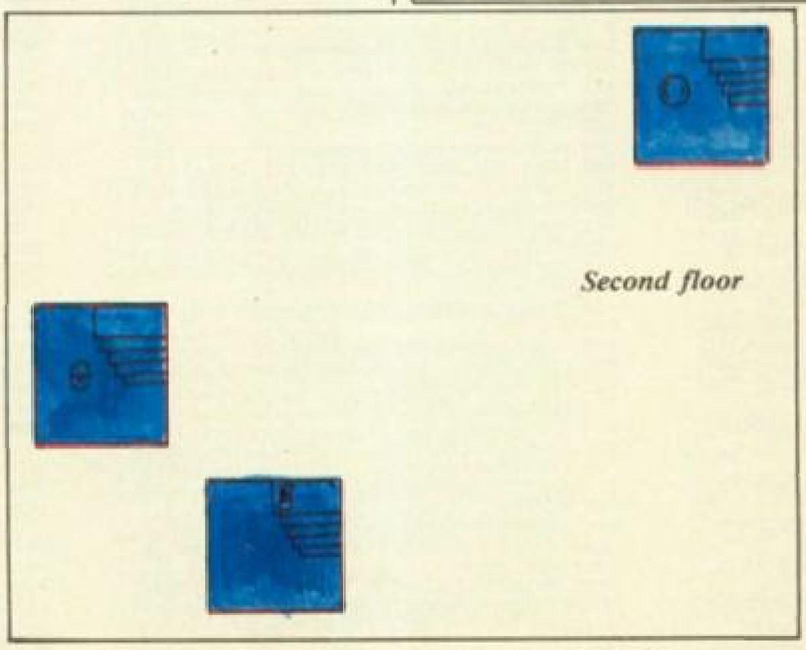
First floor

It's the dead of night — no one can hear you scream. No one, that is, except David Williams. Call him on 041-770 9599 after 9pm for help with your adventure problems.

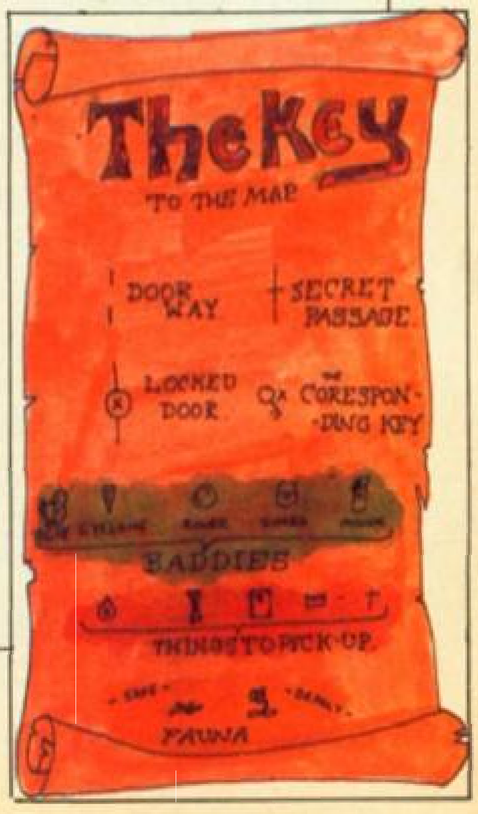


Top floor #2



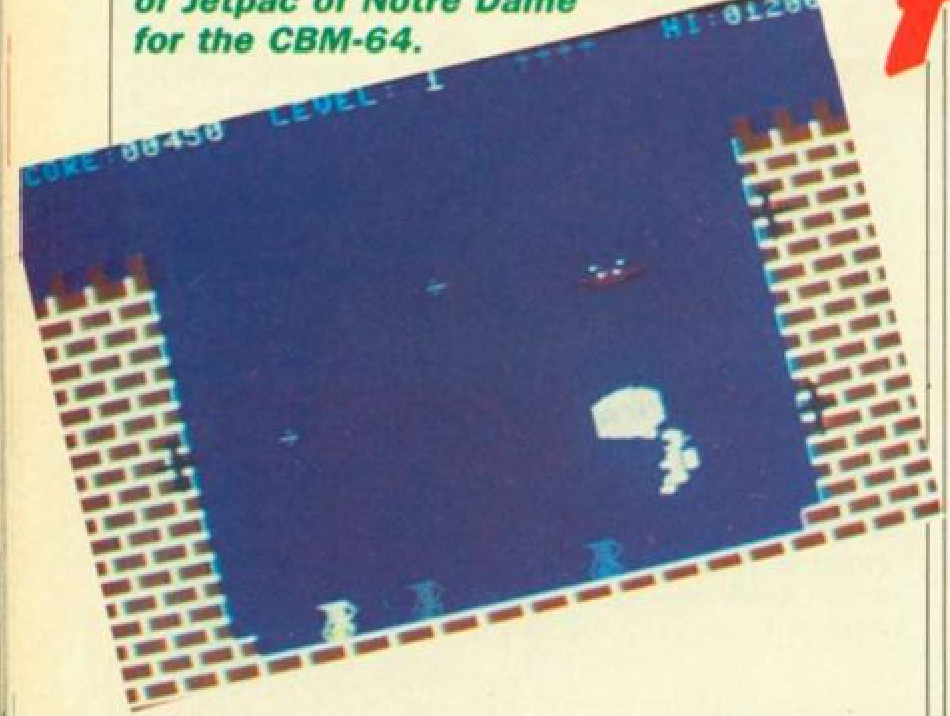


Second floor



Charlie

Michael Solomon with a sort of Jetpac of Notre Dame for the CBM-64.



After a nasty incident with a black hole Charlie Chambers, the NASA astronaut, has been transported back into medieval times.

His only way back to the present is to collect diamonds from the jugs at the bottom of the courtyard. Archers fire arrows across the castle to stop him. These marksmen can only be killed by a direct hit in their arrow slits. An olde worlde bat flies around the courtyard — he cannot be killed but a hit is worth 300 points.

Charlie must avoid the arrows and the bat to reach the jugs and then to return to the diamonds to the top of either castle wall. After clearing each screen the game gets progressivly more difficult until level 6 when the gravity factor comes into play — if Charlie doesn't move he'll be pulled downwards.

The game is written as a series of machine-code routines accessed by a control routine which in turn is accessed by one Sys call in Basic. The machine code will only return to Basic for one of six reasons.

The reason is stored in location 957 and when control is returned to Basic the program will go to the appropriate subroutine. When finished, the routines will return to the machine-code control program. The name and location of all routines are in the Rem statements among the data statement at 11000 onwards, so they can be easily disassembled.

The first program must be typed in and saved to tape, the second program should then be saved directly after the first. Listing 1 contains the Sprite data and the data for the VDGs. Listing 3 contains the game and

Listing 2.

```
10 POKE52,48:POKE56,48:CLR
20 POKE53280,0:POKE53281,0:PRINT"(CLR)(D
OWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)
(DOWN)(DOWN)(DOWN)";TAB(14);"(WHT)PLEASE
 WAIT":V=53248
25 S=54272:FORI=0TO23:POKES+I,0:NEXT:POK
ES+24,15:POKEV+21,0
30 POKE53272,29:GOSUB11000:GOSUB13000
32 FORI=1TO6:READSP(I),A1(I),A2(I),A3(I)
:NEXT:HS$="00000"
35 DIMF(13):FORI=0TO13:READF(I):NEXT
37 DIMHI(50),LO(50),DU(50):I=1
38 READHI(I),LO(I),DU(I):I=I+1:IFHI(I-1)
<>999THENGOTO38
40 REM*************************************
42 POKE53272,21:POKEV+17,PEEK(V+17)AND19
1:GOTO 2000
45 POKE833,0:POKE834,255:I=PEEK(V+30)+PE
EK(V+31)
50 FORI=0TO4:POKE835+I,1:POKE840+I,104+(
I*32):NEXT
55 POKE880,0:POKE49152+11,0
57 POKE881,0:POKE882,64:POKE887,0:FORI=0
TO49:POKE888+I,INT(RND(0)*16):NEXT
60 SC=0:SC$="00000":LE=1:LI=5:LI$=";;;;;
":DI=0
70 POKE53272,28:GOSUB 8000
80 REM*************************************
90 POKE 946,A1(LE):POKE947,A1(LE)
100 POKE948,A2(LE):POKE949,A2(LE)
110 POKE950,A3(LE):POKE951,A3(LE)
115 POKE952,SP(LE):POKE953,SP(LE):POKE95
4,2:POKE955,2
120 POKE957,0:I=PEEK(V+30)+PEEK(V+31):PO
KE834,255
130 SYS49892
140 ONPEEK(957)GOTO180,150,300,200,500,4
00
149 REM*************************************
150 POKE2047,234
155 SYS50013+13:POKEV+21,PEEK(V+21)AND22
3:JUG=PEEK(834)-1:IFJUG=-1THENJUG=4
160 POKE840+JUG,0:PRINT"(HOME)(DOWN)(DOW
N)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(D
OWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)
(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOW
N)";TAB(10+JUG*4);"  "
170 PRINTTAB(10+JUG*4);"  (HOME)":POKE83
4,255:POKEV+21,PEEK(V+21)OR128
175 SC=SC+150:GOSUB800:GOTO120
179 REM*************************************
180 FL=0:IFPEEK(V+21)>128THENFL=1
181 POKEV+14,(PEEK(V)-14)AND255:POKEV+15
,PEEK(V+1)-21:POKE2047,235
182 IF(PEEK(V+46)AND15)=1THENPOKEV+46,3
183 POKEV+21,PEEK(V+21)OR128
184 POKES+4,0:POKES,48:POKES+1,4:POKES+5
,90:POKES+6,172:POKES+2,0:POKES+3,200
186 POKES+4,65:FORI=0TO100:NEXT:POKES+4,
64
187 FORI=0TO1000:NEXT:POKEV+21,PEEK(V+21
)AND127
188 LI=LI-1:LI$=LEFT$(LI$,LI)+" ":PRINT"
(HOME)(C=5)";TAB(24);LI$:IFLI=0THEN1000
190 POKEV+21,PEEK(V+21)AND252
192 POKEV,45:POKEV+1,61:POKEV+16,PEEK(V+
16)AND254:POKE2040,226
195 POKEV+21,PEEK(V+21)OR1
197 FORI=0TO1000:NEXT
198 IFFL=0THEN120
199 SC=SC-150:GOSUB800:GOTO205
200 IFPEEK(V+21)<128THEN120
202 SC=SC+150:GOSUB800
205 POKEV+21,PEEK(V+21)AND127:POKEV+21,P
EEK(V+21)OR32:SYS50013:DI=DI+1
210 IFDI<5THEN120
220 DI=0:FORI=0TO4:POKE840+I,104+(32*I):
NEXT:FORI=0TO2:POKEV+41+I,0:NEXT
230 PRINT"(HOME)(DOWN)(DOWN)(DOWN)(DOWN)
(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOW
N)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(D
OWN)(DOWN)(DOWN)(DOWN)(DOWN)";TAB(10);"(
YEL)*+  (C=5)*+  (C=6)*+  (C=7)*+  (PUR)
*+"
240 PRINT TAB(10);"(YEL),-  (C=5),-  (C=
6),-  (C=7),-  (PUR),-(HOME)"
245 LE=LE+1:IFLE>6THENLE=1:POKE49152+11,
1
250 PRINT"(HOME)(YEL)";TAB(19);LE:GOTO 9
0
300 SL=INT((PEEK(958)AND28)/8):IF(PEEK(V
+41+SL)AND15)=2THEN120
310 POKEV+41+SL,2
330 SC=SC+250:GOSUB800
340 GOTO 120
399 REM*************************************
400 POKEV+21,PEEK(V+21)AND253
410 POKES+11,0:POKES+11,17:FORI=35TO45ST
EP2:POKES+8,I:POKES+7,135:POKES+12,24
415 POKES+13,250:FORJ=0TO10:NEXT:NEXT:PO
KES+11,16
420 POKEV+21,PEEK(V+21)AND191:POKEV+12,1
66:POKEV+13,153
430 POKEV+21,PEEK(V+21)OR64:POKE880,INT(
RND(0)*50)
440 SC=SC+300:GOSUB800:GOTO120
500 FORI=PEEK(V+15)TO224:POKEV+15,I:NEXT
:SC=SC-150:GOSUB800
510 POKE834,255:GOTO 205
520 GOTO 120
800 I$=MID$(STR$(SC),2):SC$=LEFT$("00000
",5-LEN(I$))+I$:PRINT"(HOME)(RIGHT)(RIGH
T)(RIGHT)(RIGHT)(RIGHT)(RIGHT)(YEL)";SC$
810 RETURN
999 REM*************************************
1000 POKEV+21,0:POKE53280,0:POKE53281,0
1010 FORI=0TO4
1020 PRINT"(CLR)(DOWN)(DOWN)(DOWN)(DOWN)
(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOW
N)(DOWN)(WHT)";TAB(11);"G A M E    O V E
 R"
1030 FORJ=0TO400:NEXT:PRINT"(CLR)":FORJ=
0TO400:NEXT
1040 NEXT I
1050 IFSC$>HS$THENHS$=SC$
1060 GOTO 42
1999 REM*************************************
2000 SYS50013+13:PRINT"(CLR)(DOWN)";TAB(
6);"(YEL)(C=D)(C=I)(C=I)(C=I)(C=I)(C=I)(
C=I)(C=I)(C=I)(C=I)(C=I)(C=I)(C=I)(C=I)(
C=I)(C=I)(C=I)(C=I)(C=I)(C=I)(C=I)(C=I)(
C=I)(C=I)(C=I)(C=I)(C=I)(C=F)"
2005 PRINTTAB(6);"(YEL)(RVS)(C=K)(OFF)
                    (C=K)"
2010 PRINTTAB(6);"(YEL)(RVS)(C=K)(OFF)
(BLU)C H A R L I E    A N D  (YEL)(C=K)"
2020 PRINTTAB(6);"(RVS)(C=K)(OFF)
                  (C=K)"
2030 PRINTTAB(6);"(RVS)(C=K)(OFF)       (B
LU)T H E    J U G S      (YEL)(C=K)"
2040 PRINTTAB(6);"(RVS)(C=K)(OFF)
                  (C=K)"
2050 PRINTTAB(6);"(C=C)(RVS)(C=I)(C=I)(C
=I)(C=I)(C=I)(C=I)(C=I)(C=I)(C=I)(C=I)(C
=I)(C=I)(C=I)(C=I)(C=I)(C=I)(C=I)(C=I)(C
=I)(C=I)(C=I)(C=I)(C=I)(C=I)(C=I)(C=I)(O
FF)(C=V)"
2052 PRINT"(DOWN)(DOWN)(DOWN)(DOWN)(DOWN
)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DO
WN)(DOWN)(DOWN)(DOWN)(DOWN)(RED) WRITTEN
 BY MICHAEL SOLOMON     (CYN)(C) 1985(HOM
E)"
2055 POKEV,40:POKEV+1,134:POKE2040,226:P
OKEV+39,1
2057 POKEV+2,52:POKEV+3,134:POKE2041,225
:POKEV+40,1:POKEV+16,2
2060 FORI=2TO6:POKEV+1+(I*2),134:POKEV+I
*2,112+(32*(I-2)):POKEV+39+I,I
2070 POKE2040+I,230:NEXT:POKEV+28,0:POKE
V+21,127:GOSUB9000
2080 PRINT"(DOWN)(DOWN)(DOWN)(DOWN)(DOWN
)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DO
WN)(DOWN)(DOWN)(DOWN)(DOWN)";
2090 PRINT TAB(6);"(C=1)PRESS (WHT)FIRE(
C=1) TO START THE GAME"
2110 IF(PEEK(56320)AND16)=16THEN2110
2120 PRINT"(CLR)":POKEV+21,0:GOTO45
6999 REM*************************************
8000 POKEV+17,PEEK(V+17)OR64:POKEV+34,1
8002 PRINT"(BLK)(CLR)";:FORI=0TO24:POKE1
863+I*40,37:NEXT:POKE53281,6
8005 PRINT"(HOME)(CYN)SCORE:(YEL)";SC$;"
  (CYN)LEVEL:(YEL)";LE;"  (C=5)";LI$;"
(CYN)HI:(YEL)";HS$
8007 FORI=1TO4:PRINT"(BLU)&";NEXT
8008 C$="(C=1)":IFPEEK(49152+11)=1THENC$
="(C=5)"
8010 PRINTC$" % % %";TAB(33);"% % % "C$
8015 PRINT"(SH )}(SH ()(SH )}(SH ()(SH )
)(SH ()";TAB(33);"(SH ()(SH )}(SH ()(SH
)}(SH ()(SH )}"
8020 YY$="(C=T)(C=8)":ZZ$="(C=8)(C=T)"
8025 FORI=1TO8
8030 PRINTYY$;YY$;YY$;"(BLU)&(C=8)
```

and the jugs

the machine-code routines. I can supply copies on tape for £2.99 to Sollysoft, 203 Shelly Road, Wellingborough, Northants, NN8 3EN.

Listing 1.

```
10 POKE52,40:POKE56,48:CLR
20 POKE53280,0:POKE53281,0:PRINT"(CLR)(D
OWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)
(DOWN)(DOWN)(DOWN)";TAB(14);"(WHT)PLEASE
 WAIT":V=53248
30 S=54272:FORI=0TO23:POKES+I,0:NEXT:POK
ES+24,15:POKEV+21,0
40 GOSUB 10000:GOSUB12000
50 POKE631,147:POKE632,131:POKE198,2:END
60 REM*********************************
10000 IFPEEK(12288)=60THEN10025
10010 POKE56334,PEEK(56334)AND254:POKE1,
PEEK(1)AND251
10015 FORI=0TO2047:POKE12288+I,PEEK(5324
8+I):NEXT
10020 POKE1,PEEK(1)OR4:POKE56334,PEEK(56
334)OR1
10025 FORI=0TO111:READA:IFI<=103THENPOKE
12568+I,A:GOTO10028
10026 POKE(59*8+12288)+(I-104),A
10028 NEXT
10030 RETURN
10040 DATA 0,127,127,127,127,127,127,0
10050 DATA 0,254,254,254,254,254,254,0
10060 DATA 255,255,255,255,255,255,255,2
55
10070 DATA 192,192,192,192,192,192,192,1
92
10080 DATA 3,3,3,3,3,3,3,3
10090 DATA 127,127,127,127,127,127,127,0
10100 DATA 254,254,254,254,254,254,254,0
10110 DATA 0,0,255,63,31,31,31,31
10120 DATA 0,0,224,240,216,204,204,216
10130 DATA 63,55,119,239,223,239,127,63
10140 DATA 240,192,224,240,176,176,96,19
2
10150 DATA 0,0,48,64,254,64,48,0
10160 DATA 0,0,12,2,127,2,12,0
10170 DATA 24,24,126,126,24,24,24,24
10999 REM*******************************
12000 FORI=0TO10:FORJ=0TO62:READA:POKE((
225+I)*64)+J,A:NEXT:NEXT:RETURN
12005 REM          CHARLIE 1
12010 DATA 0,240,0,0,252,0,0,60,0,0,28,0
,0,60,0,0,240,0,0,0,0,0,240,0,0,235,192
12020 DATA 0,107,192,7,235,192,7,235,192
,0,11,192,0,251,192,0,0,0,3,240,0,7,240
12025 DATA 0,7,240,0,7,0,0,31,0,0,31,0,0
12027 REM          CHARLIE 2
12030 DATA 0,31,0,0,63,0,0,60,0,0,56,0,0
,60,0,0,31,0,0,0,0,0,31,0,3,215,0
12040 DATA 3,214,0,3,215,224,3,215,224,3
,208,0,3,223,0,0,0,0,0,31,192,0,31,224
12050 DATA 0,31,224,0,0,224,0,0,240,0,0,
240
12055 REM          WINDOW SLITS
12060 DATA 0,0,0,0,28,0,0,62,0,0,28,0,0,
28,0,0,28,0,0,28,0,0,28,0,0,28,0
12070 DATA 7,255,240,7,255,240,0,28,0,0,
28,0,0,28,0,0,28,0,0,28,0,0,28,0
12080 DATA 0,28,0,0,62,0,0,28,0,0,0,0,0
12085 REM          BULLETS
12090 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
,0,0,0,0,0,0,0,0,0,0,0,0
12100 DATA 240,0,0,240,0,0,0,0,0,0,0,0,0
,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
12110 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0
,0,0,0,0,0,0,0,0,0,0,0,0,0,0
12120 DATA 0,0,31,0,0,31,0,0,0,0,0,0,0,0
,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
12130 REM          JUGS
12140 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
,255,224,0,63,240,0,31,216,0,31,204,0
12150 DATA 31,204,0,31,216,0,63,240,0,55
,192,0,119,224,0,239,240,0,223,176,0
12160 DATA 239,176,0,127,96,0,63,192,0,0
,0,0,0,0,0
12165 REM          BAT 3
12170 DATA ..............................
.......3,0,192,0,85,0,0,85,0,0,215,0
12180 DATA 2,85,128,10,85,160,42,150,160
,160,0,42,128,0,2
12185 REM          BAT 2
12190 DATA ..............................
.......3,0,192,0,85,0,0,85,0,160
12200 DATA 215,42,170,85,170,10,85,160,2
,150,128,......
12205 REM          BAT 1
12210 DATA ..............................
.......3,0,192,128,85,2,160,85
12220 DATA 42,42,215,168,10,85,160,2,85,
128,0,150,0,......
12225 REM          DIAMOND
12230 DATA 0,0,0,0,42,0,0,166,128,2,154,
160,0,166,128,0,42,0,0,0,0
12240 DATA ..............................
..............0
12245 REM          BUBBLE
12246 DATA 0,0,0,0,0,0,0,0,0,0,255,0,15,
255,240,63,255,252,255,255,255,251,251
12250 DATA 187,234,251,187,238,251,187,2
38,251,187,234,250,191,238,251,191,238
12260 DATA 251,187,238,251,187,255,255,2
55,255,252,15,255,240,0,255,192,0,3
12270 DATA 240,0,0,240
```

```
                    ";"(BLU) ";C$;ZZ$;ZZ$
;ZZ$
8040 PRINTZZ$;ZZ$;ZZ$;"(BLU)&(C=8)
                    ";"(BLU) ";C$;YY$;YY$
;YY$
8050 NEXT
8060 PRINT YY$;YY$;YY$;"(C=T)";TAB(32);"
(C=T)";ZZ$;ZZ$;ZZ$
8070 PRINT"(C=@)(C=T)(C=@)(C=T)(C=@)(C=T
)(C=@)(C=T)(C=@)(C=T)(C=@)(C=T)(C=@)(C=T
)(C=@)(C=T)(C=@)(C=T)(C=@)(C=T)(C=@)(C=T
)(C=@)(C=T)(C=@)(C=T)(C=@)(C=T)(C=@)(C=T
)(C=@)(C=T)(C=@)(C=T)(C=@)(C=T)(C=@)(C=T
)(C=@)(WHT)(HOME)";
8071 PRINT"(DOWN)(DOWN)(DOWN)(DOWN)(DOWN
)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DO
WN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(
DOWN)(DOWN)(DOWN)(DOWN)";TAB(10);"(YEL)*
*  (C=5)**  (C=6)**  (C=7)**  (PUR)**"
8072 PRINT TAB(10);"(YEL),-  (C=5),-  (C
=6),-  (C=7),-  (PUR),-(HOME)"
8075 POKEV,45:POKEV+1,61:POKEV+39,1:POKE
2040,226:POKEV+40,0:POKE2041,228
8080 POKEV+4,26:POKEV+5,117:POKEV+41,0:P
OKE2042,227
8085 POKEV+6,26:POKEV+7,189:POKEV+42,0:P
OKE2043,227
8090 POKEV+8,54:POKEV+9,157:POKEV+16,12:
POKEV+43,0:POKE2044,227
8095 POKEV+11,223:POKEV+44,6:POKE2045,23
0:POKEV+27,34
8097 POKEV+28,192:POKEV+12,166:POKEV+13,
153:POKEV+45,8:POKEV+37,4:POKEV+38,1
8098 POKE 2046,231
8099 POKEV+46,3:POKE2047,234
8110 POKEV+21,125:SYS 50013
8120 RETURN
8999 REM*******************************
9000 REM      PLAY TITLE TUNE
9005 I=1:POKES+2,0:POKES+3,8
9010 IFLO(I)=999THENPOKES+4,64:RETURN
9020 POKES+5,24:POKES+6,250:POKES+4,0:PO
KES+4,65
9030 POKES,LO(I):POKES+1,HI(I)
9040 FORJ=0TODU(I)*55:NEXT
9050 I=I+1:GOTO9010
10999 REM******************************
11000 A=49152
11010 READA$:IFA$="***"THEN:RETURN
11020 FORJ=1TOLEN(A$)STEP2
11030 Y$=MID$(A$,J,1):Z$=MID$(A$,J+1,1)
11040 Y=ASC(Y$)-48:IFY>9THENY=Y-7
11050 Z=ASC(Z$)-48:IFZ>9THENZ=Z-7
11060 POKEA,Y*16+Z:A=A+1:NEXT:GOTO11010
11062 REM -- MOVE MAN/LOOK UP(49152) --
11065 DATA 00000000FFFFFF00010101
11067 DATA 00FF010000FF010000FF01
11070 DATA AD00DC290F490FAAF00BA9E1E007
11080 DATA 9002A9E28DF807AD00D0187D00C0
11090 DATA 8D00D0AD01D0187D08C0C9389003B
D01D0
11100 DATA AE00D0AD10D02901D00DE000D008
11110 DATA A9010D10D08D10D060E0FFD008
11120 DATA A9FE2D10D08D10D060
11125 REM ----- BULLET (49255) -----
11130 DATA AD15D02902D053AD00DC2910F001
11140 DATA 60AE00D08E02D0AE01D0E0D080F28
E03D0
11150 DATA AD10D02901F00BAD10D00902
11160 DATA 8D10D0189008AD10D029FD8D10D0
11170 DATA AD15D009028D15D0ADF807186903
11180 DAJA 8DF907C9E5F006A9FF8D400360
11190 DATA A9018D400360
11200 DATA AE02D0D000AD10D049028D10D08A
11210 DATA 186D40038D02D0AD1FD02902F008
11220 DATA AD15D029FD8D15D060
11230 REM -- JUG INTERRUPTS (49382) --
11240 DATA EAEAEAEAEAEAEAEAEAEAEAEAEAEA
11245 DATA EAEAEAEAEAEAEAEAEAEA
11250 DATA AE4103AD1ED02920F0068E4203
11260 DATA 4C31EA8D4303F0068D40038D0AD0
11270 DATA E8E005D002A2008E41034C31EA
11280 REM ---- LEFT ARROWS (49444) ----
11290 DATA A200A007C8B1FBC92ED001E888
11300 DATA 91FBC8C01FD0F0A92091FB60
11310 REM --- RIGHT ARROWS (49469) ----
11320 DATA A200A01F88B1FBC92FD001E8C8
11330 DATA 91FB88C007D0F0A92091FB60
11340 REM --- ARROWS CONTROL (49494) --
11350 DATA A96885FBA90585FC2024C18E4D03
11360 DATA A93085FBA90685FC203DC18E4E03
11370 DATA A9D085FBA90685FC2024C18E4F03
11380 DATA 60
11385 REM ---- BAT CONTROL (49537) ----
11390 DATA AE77038DAA031869E78DFE07209EC
1AE77
11400 DATA 03E8E008D002A2008E770360
11405 REM ----- MOVE BAT (49566) -----
11407 DATA AE70038D7803AA
11410 DATA AD0DD0187D6003A8AD0CD018
11420 DATA 7D5003C053901FC0C9B01BC951
11430 DATA 9017C9FFB0138D0CD08C0DD0
11440 DATA AC7103C8CC7203F0048C710360A00
0
11450 DATA 8C7103AE7003E8E032D002A200
11460 DATA 8E700360
11465 REM -- MOVE EVERYTHING (49642) --
11470 DATA 2016C02067C02067C0CEB803D009
11480 DATA ADBA038DB80320B1C1
11490 DATA AD29D0290FD013CEB303D00EADB2
11500 DATA 038DB303A92E8D07052O5EC2
11510 DATA AD2BD0290FD013CEB503D00EADB4
11520 DATA 038DB503A92F8D3706205EC2
11530 DATA AD2AD0290FD013CEB703D00EADB6
11540 DATA 038DB703A92E8DEF06205EC2
11550 DATA CEB903D009AEB8038EB9032056C1
11560 DATA 60
11570 REM ---- ARROW SOUND (49758) ----
11580 DATA A9008D04D4A9508D05D4A90F8D06
11590 DATA D4A9498D00D4A9148D01D4A9818D
11600 DATA 04D460
11605 REM ---     CHECKS (49789)     ---
11607 DATA AD1ED08DBE03
11610 DATA AD15D02980D00CAE4203E0BF006
11620 DATA A9028DBD0360AD1FD02901D007
11630 DATA ADBE032901F006A9018DBD0360
11640 DATA ADBE03291CF006A9038DBD0360
11650 DATA AD00DC925D006A9048DBD0360
11660 DATA ADBE032980F006A9058DBD0360
11670 DATA ADBE032940F006A9068DBD0360
11680 DATA A9008DBD0360
11685 REM --- MAIN PROGRAM (49892) ---
11690 DATA 20EAC1AD00D08D0ED0AD10D02901
11700 DATA F00BAD10D009808D10D0189008
11710 DATA AD10D0297F8D10D0EE2ED0AD01D0
11715 DATA 1869168D0FD0207DC2
11720 DATA A200A0FF88D0FDCAD0F8ADBD03
11730 DATA F08FC901F005C904F02060AE00D0A
C01D0
11732 DATA E0549014E0FDB010C0CD900CC0DF
11733 DATA B008A9008DBD034CE4C2
11734 DATA 60AD15D02980D000
11735 DATA A9008DBD034CE4C260
11737 REM --- TURN ON INTS  (50013) ---
11740 DATA 78A9E68D1403A9C08D15035860
11745 REM --- TURN OFF INTS (50026) ---
11750 DATA 78A9318D1403A9EA8D15035860
11998 DATA ***
11999 REM******************************
12999 REM    LOOK UP TABLES FOR BAT
13000 FORI=0TO31:READA:POKE848+I,(A AND2
55):NEXT
13010 FORI=0TO 7:READA:POKE938+I,A:NEXT
13020 DATA 0,1,2,2,2,2,2,1,0,-1,-2,-2,-2
,-2,-2,-1
13030 DATA -2,-2,-2,-1,0,1,2,2,2,2,2,1,0
,-1,-2,-1
13040 DATA 0,0,1,1,2,2,1,1
13050 RETURN
13099 REM******************************
13100 REM    ARROW SPEEDS AND DELAYS
13110 DATA 6,190,150,170
13120 DATA 6,150,100,120
13130 DATA 4,100,70,50
13140 DATA 4,100,70,50
13150 DATA 2,100,90,120
13160 DATA 2,50,90,60
13165 REM******************************
13170 REM      MUSIC NOTE VALUES
13180 DATA 451,506,268,301,337,358,401,4
77,0,284,318,0,379,425
13199 REM******************************
13200 DATA 18,209,3,19,239,3,21,31,3,33,
135,5,21,31,3,33,135,5,21,31,3,33,135,8
13210 DATA37,162,3,39,223,3,42,62,3,33,1
35,3,37,162,3,42,62,5,31,165,3,37,162,5
13220 DATA33,135,8,33,135,2,37,162,2,42,
62,2,33,135,2,37,162,2,42,62,4,33,135,2
13230 DATA37,162,2,33,135,2,42,62,2,33,1
35,2,37,162,2,42,62,4,33,135,2,37,162,2
13240 DATA33,135,2,42,62,2,33,135,2,37,1
62,2,42,62,4,31,165,2,37,162,4,33,135,6
13900 DATA 999,999,999
```

Telsoft

The programs given here will enable Spectrum, BBC, and CBM-64 owners to download via *Your Computer's* Telsoft service. Each month for each machine we transmit least one — and usually two — of the main programs appearing in the current issue. Also available is the full user to user communications program Dialsoft.

So far OE LTD's Telemod 2 and the VTX 5000 modems have been tested with the BBC and Spectrum but the service also works with a number of other makes. For the CBM-64 it will initially only be available with the OEL Comms pack together with the Telemod 2 or similar modem; later we hope to adapt the service to work with Commodore's modem.

Hexloader

To enter the download program first type in the hex-loader for your machine — figure 1 — and then enter the machine code — figure 2. Once the program has been saved you can run it by entering CALL &6000 on the BBC, SYS 51000 on the CBM 64, RANDOMIZE USR 60000 on the Spectrum.

To find out what is available and how to receive software dial up Colchester (0206) 8068. This audio recorded information line will also advise you which telephone numbers to ring for the 300 and 1200 bits/ services.

When a program you want to

Figure 1. CBM-64.

```
5 REM   HEX LOADER FOR CBM 64   FIG.1
6 REM
10 FOR I=680 TO 727:READA:POKEI,A:T=T+A
20 NEXT:IF T=6716 THEN GOTO 100
30 PRINT"ERROR IN DATA ",T-6716:END
40 DATA 169,1,133,186,169,1,133,184
50 DATA 133,185,169,8,133,183,169,208
60 DATA 133,187,169,2,133,188,169,56
70 DATA 133,251,169,199,133,252,169,251
80 DATA 162,231,160,206,32,216,255,96
90 DATA 68,79,87,78,76,79,65,68
100 SA=51000:LA=52855
110 INPUT"START ADDRESS";A
120 IF (A<SA) OR (A>LA) THEN GOTO 140
130 IF A/8=INT(A/8) THEN GOTO 150
140 PRINT:PRINT"ADDRESS ERROR":GOTO 110
150 T=(A-32768)AND255:PRINTA;:INPUTD$
160 IF D$="END" THEN GOTO 900
170 IF LEN(D$)<>20 THEN GOTO 190
180 PRINT"WRONG LENGTH":GOTO 150
190 FOR B=0 TO 7:B$=MID$(D$,2*B+1,2)
200 GOSUB 300:IF E=1 THEN GOTO 280
210 POKE A+B,D:T=T+D:NEXT
220 B$=MID$(D$,18,3):GOSUB 300
230 IF E=1 THEN GOTO 280
240 IF T=D THEN GOTO 260
250 PRINT"CHECKSUM ERROR":GOTO 150
260 A = A+8:IF A<LA THEN GOTO 150
270 GOTO 800
280 PRINT TAB(8+2*B+D)C$"??"
290 B=8:NEXT:GOTO 150
300 E=0:D=0:FOR N=1 TO LEN(B$)
310 C$=MID$(B$,N,1):GOSUB 400
320 IF E=1 THEN D=N:N=4:NEXT:RETURN
330 D=D*16+X:NEXT:RETURN
400 X=ASC(C$)-48:IF X<0 THEN E=1:RETURN
410 IF X<10 THEN RETURN
420 X=X-7:IF X<10 THEN E=1:RETURN
430 IF X>15 THEN E=1
440 RETURN
500 H$="0123456789ABCDEF"
510 FOR A=SA TO LA STEP 8
520 PRINT A;"? ";:T=(A-32768)AND255
530 FOR B=0 TO 7:X=PEEK(A+B):GOSUB 600
540 T=T+X:NEXT:PRINT"=";
560 Y=INT(T/256):PRINT MID$(H$,Y+1,1);
570 X=255 AND T:GOSUB 600:PRINT
580 NEXT:GOTO 900
600 PRINT MID$(H$,INT(X/16)+1,1);
610 PRINT MID$(H$,1+(XAND15),1);:RETURN
800 SYS 680:C$=CHR$(34)
810 PRINT:PRINT" TO RELOAD CODE :"
815 PRINT:PRINT"  LOAD"C$"DOWNLOAD";
820 PRINTC$",1,1  (RETURN)"
825 PRINT:PRINT"  THEN TYPE   NEW";
830 PRINT"  (RETURN)"
835 PRINT:PRINT"TO RUN THE PROGRAM";
840 PRINT"  SYS 51000  (RETURN)"
900 PRINT:PRINT:PRINT"1  ENTER DATA"
910 PRINT:PRINT"2  PRINT DATA"
920 PRINT:PRINT"3  SAVE DATA"
930 INPUT Z:ON Z GOTO 100,500,800
```

Figure 2. CBM-64.

```
51000 ? A9068D21D08D20D0=3E2
51008 ? A90F8D8602A90E20=2E4
51016 ? D2FFA9008D15D0A9=4DD
51024 ? FF8D0A02BA8E92CE=510
51032 ? 20CAC920C7CB20F8=4D5
51040 ? CAAD80CEC931F023=532
51048 ? C935F014C936D006=43F
51056 ? 208EC74C5BC7A914=410
51064 ? 20D2FF202FCBD0DB=52E
51072 ? 203FC8A92020D2FF=461
51080 ? 4C93C94C4AC82063=411
51088 ? CC2022CDA95B85FD=4F1
51096 ? A9CE85FE2028CDA0=547
51104 ? 002095CC202FCBC9=404
51112 ? 44F00BC954D0ED20=4E1
51120 ? D2FFA901D007A944=4EF
51128 ? 20D2FFA90885BA20=4B9
51136 ? 25CDA90820ABCCA9=4A3
51144 ? BD85FDA9CD85FEA0=6A0
51152 ? 002095CC2025CD20=383
51160 ? 95CC9848A0048C83=4CC
51168 ? CE20D8C968A82025=4C4
51176 ? CD2095CC9848A906=4C5
51184 ? 8D83CE20D8C9ADA7=5E3
51192 ? CE85FBADA8CE85FC=6EA
51200 ? 68A82060CBA90185=38A
51208 ? B885B998A293A0CE=539
51216 ? 20BDFFAEA9CEACAA=567
51224 ? CEE8D001C82025CD=479
51232 ? A9FB20D8FF20F1CB=597
51240 ? 6020D9CCC90DD00B=3FE
51248 ? A90085C7A92020D2=3E0
51256 ? FFA90D20D2FF60A9=4E7
51264 ? 0D2029C8A90D20D2=306
51272 ? FF602063CCA000A9=43F
51280 ? FF9993CEC8D0FA20=5FB
51288 ? D2CB90FB20D2CBB0=5ED
51296 ? FB0D72CEA0008C7C=4D0
51304 ? CE8C7DCE202ECCAD=4D4
51312 ? 72CE29F0C980D0E4=5C6
51320 ? 20D2CBB0DA9973CE=599
51328 ? C8202ECCC009D0F0=4EB
51336 ? A000AD76CE2980D0=492
51344 ? 0FA52B85FB18A52C=3D8
51352 ? 6D75CE85FC4CA0C8=587
51360 ? AD78CE85FBAD79CE=607
51368 ? 85FC20D2CBB0A820=55E
51376 ? D9CC20D2FFC820D9=607
51384 ? CC202ECCC010D0EA=528
51392 ? A92020D2FFAD75CE=56A
51400 ? 202ECD20D2CBB087=4D7
51408 ? CD7CCEF00BA95820=503
51416 ? D2FF2030C84C57C8=52C
51424 ? 20D2CBB0F8CD7DCE=65D
51432 ? D0EBAD75CEA8B993=687
51440 ? CED00E2030C8A991=4EE
51448 ? 20D2FF4C7FC94C57=51F
51456 ? C8A0008C7CCE8C7D=447
51464 ? CE20D2CBB0F091FB=5BF
51472 ? 202ECCC0CC77CED0=4D3
51480 ? F020D2CBB0E0CD7C=59E
51488 ? CEF000A95820D2FF=4D8
51496 ? 4C57C820D2CBB0CE=4CE
51504 ? CD7DCEF0034C23C9=473
51512 ? 20ACCB2030C8AD75=409
51520 ? CEA8A9009993CEAD=506
51528 ? 84CEC902D02520BC=436
51536 ? CBA9C820F3CBA955=568
51544 ? 2016CDA95820F3CB=432
51552 ? 20C7CBAC73CEC888=54F
51560 ? B993CED02398D0F7=5D4
51568 ? 4C5BC7A9552016CD=3DF
51576 ? 20F1CB4C63C9AC77=4EF
51584 ? CE20D2CB88D0FA20=57D
51592 ? D2CB20D2CB4C47C9=53E
51600 ? 4C5CC8A52B85FBA5=4F5
51608 ? 2C85FCA000B1FB99=52A
51616 ? 2200C8B1FB8523F0=4CE
51624 ? 0BA52285FBA52385=447
51632 ? FC4C9BC918A5FB69=57D
51640 ? 02852D852F8531A5=37B
51648 ? FC6900852E853085=412
51656 ? 32602063CCA9028D=3E1
51664 ? 84CEA90B8D02DE60=4A3
51672 ? 8E81CE8C82CEA200=533
51680 ? A9098DCDCE202FCB=4D4
51688 ? C914F016C90DF051=4E2
51696 ? C924D01920D2FF8D=544
51704 ? C3CEE84CE5C9E000=64B
51712 ? D0E3EA00F0DF20D2=554
51720 ? FFCA4CE5C9C93090=554
51728 ? D4C93A901548ADC3=444
51736 ? CEC924F004684CE5=460
51744 ? C969C94190BFC947=4BA
51752 ? B0BB20D2FF38E930=4D5
51760 ? C90A9002E907E005=36A
51768 ? F0AB9DC3CEE84CE5=61A
51776 ? C9E000F0A0E001D0=52A
51784 ? 07ADC3CEC924F095=4FF
51792 ? A92020D2FFA9FF9D=54F
51800 ? C3CEA2008ECFCE8E=544
51808 ? D0CE8ED1CE8ED2CE=659
51816 ? ADC3CEC924D006A9=512
51824 ? 0F8DCDCEE8BDC3CE=5DD
51832 ? C9FFF01D20CBCAB0=5B2
51840 ? 3418BDC3CE6DCFCE=524
51848 ? 8DCFCEA9006DD0CE=566
51856 ? 8DD0CEB020E84C75=534
51864 ? CAADCFCEAC83CE99=642
51872 ? A3CEC8ADD0CE99A3=660
51880 ? CEC8188C83CEAC82=561
51888 ? CEAE81CE602025CD=4ED
51896 ? A2008D41CEC921F0=500
51904 ? 0720D2FFE84CBACA=570
51912 ? 4CDEC9ADCDCE8DCE=65E
51920 ? CEADCFCE8DD1CEAD=6C1
51928 ? D0CE8DD2CE18ADD1=639
51936 ? CE6DCFCE8DCFCEAD=68F
51944 ? D2CE6DD0CE8DD0CE=6BE
51952 ? B005CECFCED0E660=625
51960 ? 2063CCA90F8D8602=414
51968 ? A95185FDA9CD85FE=575
51976 ? A000209DCC2025CD=343
51984 ? 209DCC209DCC209D=3DF
51992 ? CC2022CD20A9CC20=3A6
52000 ? 95CC2022CD2095CC=411
52008 ? 202FCB20D2FF608E=421
52016 ? 81CE8C82CE2069CC=4B0
52024 ? 20ECCC20CACCC900=48F
52032 ? D00D20FDCCC931F0=4F0
52040 ? 062001CC4C35CB8D=314
52048 ? 80CEAE81CEAC82CE=597
52056 ? 60AE92CE9A4C5BC7=4CE
52064 ? 2022CDA92285FDA9=465
52072 ? CE85FEA0002095CC=4DA
52080 ? 2025CDA00FA92099=393
52088 ? 93CE88D0FA8D93CE=619
52096 ? 202FCBC914D010C0=417
52104 ? 00F0F520D2FF88A9=50F
52112 ? 209993CE4C80CBC9=50A
52120 ? 0DF00B20D2FF9993=4BD
52128 ? CEC8C010D0DAA920=579
52136 ? 20D2FF60A92020D2=4B4
52144 ? FFA94F20D2FFA94B=58C
52152 ? 20D2FF60A9138D00=452
52160 ? DEA9128D00DE60A9=4CD
52168 ? 538D00DEA9528D00=40E
52176 ? DE60A996188D87CE=547
52184 ? 8C82CEAC82CE2004=4D4
52192 ? CC20ECCCCE87CED0=677
52200 ? 02386020FDCCB0EE=509
52208 ? 60A9FA8C82CEA820=597
52216 ? 04CC88D0FAAC82CE=616
52224 ? 602004CC8AA2A8CA=3EE
52232 ? D0FDAA2069CC6020=454
52240 ? 25CDA90220ABCC20=364
52248 ? 95CCAD8ECE20D2FF=573
52256 ? A92020D2FFA90320=3A6
52264 ? ABCC20D8C9604D7D=48A
52272 ? CE8D7DCEA208AD7D=4AA
52280 ? CE2A9010AD7DCE49=411
52288 ? 088D7DCEAD7CCE49=460
52296 ? 108D7CCE2E7CCE2E=3D5
52304 ? 7DCECAD0E160A000=516
52312 ? A9009900D4C8C018=40E
52320 ? D0F660A99320D2FF=5B3
52328 ? 6048A5A2290FD01F=37E
52336 ? A5D448A5A22910F0=4A1
52344 ? 05A9A44C80CCA920=42B
52352 ? 20D2FFA90085D4A9=51C
52360 ? 9D20D2FF6885D468=53F
52368 ? 6020D2FFC8B1FDC9=620
52376 ? 21D0F6C8602025CD=4B9
52384 ? A90C20ABCC2095CC=46D
52392 ? 60A9058E81CEAAA9=4E6
52400 ? 2020D2FFCAD0FAAF=603
52408 ? 81CE60C914F008C9=505
52416 ? 7FF00160A91460A9=456
52424 ? 7F6020E4FFC9C190=5C4
52432 ? 07C9DBB00338E960=4AF
52440 ? 60C941900EC95B90=494
52448 ? 08C9619006C97BB0=49C
52456 ? 02492060488A4800=2D5
52464 ? 20E1FFD0034C59CB=533
52472 ? 2868AA6860AD00DE=485
52480 ? 49016A9003A90060=250
52488 ? AD01DE6048AD00DE=3C7
52496 ? 49026A6A6860200C=223
52504 ? CDB0FB8D01DE20EC=508
52512 ? CC602025CD2028CD=373
52520 ? A90D20D2FF604829=3A0
52528 ? F06A6A6A6A0930C9=3CA
52536 ? 3A300318690720D2=21F
52544 ? FF68290F0930C93A=31B
52552 ? 300318690720D2FF=2F4
52560 ? 60444F574E4C4F41=2C4
52568 ? 44204D454E552131=243
52576 ? 2020205245434549=228
52584 ? 5645213520202045=1FE
52592 ? 58495420544F2042=28A
52600 ? 4153494321362020=22F
52608 ? 2053415645204259=28A
52616 ? 5445532128205553=285
52624 ? 4520122053544F50=26D
52632 ? 209220544F205245=2C4
52640 ? 5455524E20544F20=2CC
52648 ? 4D454E5520292145=28C
52656 ? 4E544552204E554D=2F9
52664 ? 4245522021494620=281
52672 ? 4144445245535320=2E6
52680 ? 495320494E204845=2C8
52688 ? 582C119D9D9D9D9D=476
52696 ? 9D9D9D9D9D9D9D9D=5C0
52704 ? 9D9D9D9D50524546=481
52712 ? 4958205749544820=305
52720 ? 2421535441525420=2E3
52728 ? 4144445245535320=31E
52736 ? 464F522041524541=220
52744 ? 202146494E414C20=1D3
52752 ? 4144445245535320=236
52760 ? 464F522041524541=238
52768 ? 202150524F475241=22C
52776 ? 4D205449544C4520=237
52784 ? 284D415820313620=1E5
52792 ? 4348415227532920=219
52800 ? 21124E4F54205641=21B
52808 ? 4C4944922C205452=2A5
52816 ? 5920414741494E20=249
52824 ? 3A20214449534320=216
52832 ? 4F52205441504520=26B
52840 ? 2820442F54202920=1E0
52848 ? 3F21000000000000=0D0
```

A reminder of how to use the Telsoft service.

download is on line, make sure your modem is set up and dial the number appropriate to its speed. As soon as you hear the modem tones switch the modem to line and replace the receiver. Select Option 1 from the menu — Receive. After a block of data is received you will see "OK" printed if there are no errors, otherwise the program will wait for the blocks to come round again. When the "Program loaded OK" message appears return to the Telsoft menu and select Option 5. You can now save and run.

Option 6 for CBM-64

Note that CBM-64 owners will need to use Option 6 if machine code is to be saved.



Figure 1. BBC.

```
10 REM BBC HEX CODE LOADER
15 HIMEM=&69FF
20 CLS:PRINT
30 INPUT " START ADDRESS (Hex)";A$
40 A=EVAL("&"+A$)
50 IF A>&6F87 THEN 280
60 IF A<&2A00 OR A>&6FE7 THEN 20
70 PRINT ~A" ";
80 INPUT ":" B$,C$
90 IF LEN(B$) <>16 THEN 50
100 T=0
110 FOR N=0 TO 7
120 X$= MID$(B$,2*N+1,1): GOSUB 300
130 IF E=1 THEN 260
140 X$= MID$(B$,2*N+2,1): GOSUB 300
150 IF E=1 THEN 260
160 B= EVAL("&"+MID$(B$,2*N+1,2))
170 ?A=B:A=A+1:T=T+B
180 NEXT
190 FOR M = 1 TO LEN (C$)
200 X$=MID$(C$,M,1):GOSUB 300
210 IF E =1 THEN A=A-1: GOTO 260
220 NEXT
230 IF T= EVAL("&"+C$) THEN 50
240 PRINT "CHECKSUM ERROR !"
250 A=A-8:GOTO 50
260 PRINT "TYPING ERROR !"
270 A=8*(A DIV 8):GOTO 50
280 *SAVE "DOWNLOAD" 6A00 6F87
290 END
300 E=0:IF ASC(X$)<48 THEN E=1:RETURN
310 IF ASC(X$)<58 THEN RETURN
320 IF ASC(X$)<65 THEN E=1:RETURN
330 IF ASC(X$)>71 THEN E=1
340 RETURN
```

Figure 2. BBC.

```
6A00 :A9CBA0FEA20120F4,4C6
6A08 :FF20616C20486DC9,38A
6A10 :31F000C934F0E9C9,4C8
6A18 :35F0064C0C6A4C47,200
6A20 :6AA90C20E3FFA9E8,482
6A28 :A000A2FF20F4FFA9,4FD
6A30 :03A20020F4FFA902,363
6A38 :A20220F4FFA9CBA0,4C8
6A40 :FEA20020F4FF60A9,4BC
6A48 :0C20E3FF20F76BA9,439
6A50 :15A20120F4FFA000,3E8
6A58 :A9FF8899056FD0FA,587
6A60 :A915A20120F4FF20,394
6A68 :0C6C90F8200C6C80,348
6A70 :FBA0008477847884,416
6A78 :79847A8478857020,380
6A80 :D56DA57029F0C900,489
6A88 :D0E2200C6C80D099,468
6A90 :7100C820D56DC009,364
6A98 :D0F0A000A5742900,422
6AA0 :D000A51C057618A5,354
6AA8 :1D65730577200C6C,209
6AB0 :800520E3FFC820D5,524
6AB8 :6DC018D0F0A57320,435
6AC0 :B26D200C6C80A0C5,3CC
6AC8 :7AF000A95020E3FF,470
6AD0 :20E7FF4C676A200C,34F
6AD8 :6C800CC570F000A9,48C
6AE0 :5020E3FF20E7FF4C,4AC
6AE8 :676AA573A889856F,43E
6AF0 :D00E20E7FFA90820,380
6AF8 :E3FF4C836B4C676A,469
6B00 :A000847A847B200C,2C9
6B08 :6CB0F2917620D56D,477
6B10 :CBC47500F1200C6C,45A
6B18 :B0E3C57AF000A958,4CE
6B20 :20E3FF20E7FF4C67,488
6B28 :6A200C6C80CFC578,3C1
6B30 :F000A95020E3FF4C,447
6B38 :676A20C76B20E7FF,429
6B40 :A573A8A90089856F,3F6
6B48 :A58AC902D05820D7,419
6B50 :6BA9C820556CA955,388
6B58 :20306EA95020556C,298
6B60 :A915A20120F4FF20,394
6B68 :F76BA471C0888985,505
6B70 :6FD05198D0F7A90C,4A4
6B78 :20E3FF20A56DA95A,437
6B80 :8502A96F8503A907,3D7
6B88 :20006E20F86D20A8,2D8
6B90 :6DA90520006EA900,2DA
6B98 :20E3FF20F86DA9D2,502
6BA0 :20E0FF4C0C6AA955,38F
6BA8 :20306EA99620556C,2DE
6BB0 :4C6A68A475200C6C,2D2
6BB8 :80D0FA200C6C200C,316
6BC0 :6C4C48684C6C6AA9,336
6BC8 :2020E3FFA96F20E3,43D
6BD0 :FFA96820E3FF60A9,51E
6BD8 :9CA000A68AE002D0,41E
6BE0 :08A21320F4FFA212,387
6BE8 :20F4FF60A29220F4,4C0
6BF0 :FFA29620F4FF60A9,553
6BF8 :9CA000A68AE002D0,41E
6C00 :EBA25320F4FFA252,4E7
6C08 :20F4FF6018A99685,44F
6C10 :8F847EA991A20020,38D
6C18 :F4FF8009C007D005,448
6C20 :68684C0C6AA47E20,2D4
6C28 :496CC60FD0023860,374
6C30 :A58AC902D0062079,369
6C38 :6E80EC60A991A201,447
6C40 :20F4FF98A47E80DF,55C
6C48 :600AA2D2CAE0CAD0,5AA
6C50 :F8AA60A900847EA8,458
6C58 :20496C88D0FAA47E,449
6C60 :60A9E8A000A2FF20,452
6C68 :F4FFA900858AA90C,460
6C70 :20E3FF20A86DA904,3E4
6C78 :20006EA9098582A9,2F0
6C80 :6F8503A90020F86D,39C
6C88 :20156DC941F000C9,370
6C90 :42F011C943F0174C,3A2
6C98 :616CA900A20120F4,335
6CA0 :FF4C876CA900A203,3C4
6CA8 :20F4FF4C876CA900,433
6CB0 :A20420F4FFE68AA5,4CE
6CB8 :7C20E3FFA47E20A8,468
6CC0 :6DA90820006E20F8,2C4
6CC8 :6DA01720156DC941,2D0
6CD0 :F000C942F011C943,413
6CD8 :F0174C616CA907A2,372
6CE0 :0120F4FF4C096DA9,37F
6CE8 :07A20320F4FF4C09,314
6CF0 :6DA907A20420F4FF,3D6
6CF8 :E68AA58AC9[illegible]D009,443
6D00 :A9E8A000A20120F4,3E8
6D08 :FFA57C20E3FF2053,495
6D10 :6C20536C6020A86D,2E3
6D18 :A90520006E20F86D,2C1
6D20 :20A86DA90520006E,274
6D28 :20F86D20A86DA905,368
6D30 :20006E20F86D20A8,2DE
6D38 :6D847EA90320006E,2A9
6D40 :A9D220E0FF857C60,4DB
6D48 :A90C20E3FF20A86D,3EF
6D50 :A90720006EA99A85,386
6D58 :82A96E8503A00020,361
6D60 :F86D20A86D20996D,3C0
6D68 :20996D20996D20A8,317
6D70 :6DA90A20006E20F8,2C6
6D78 :6D20A86DA9022000,270
6D80 :6E20F86D20A86D20,348
6D88 :E7FFA9D220E0FF48,5A0
6D90 :A90FA20020F4FF60,3D5
6D98 :60A90020006E20F8,287
6DA0 :6D20A86D6020A86D,33A
6DA8 :20A86D20E7FF20E7,445
6DB0 :FF604829F06A6A6A,3FE
6DB8 :6A0930C93A300318,1F1
6DC0 :690720E3FF60290F,312
6DC8 :0930C93A30031869,1F0
6DD0 :0720E3FF60457805,3AE
6DD8 :78A200A5782A900C,388
6DE0 :A57849000578A57A,390
6DE8 :4910057A267A2678,299
6DF0 :CAD0E86020E3FFC8,5AC
6DF8 :8102C90DD0F6C860,4F7
6E00 :867DAAA92020E3FF,478
6E08 :CAD0FAA67D60C97F,55F
6E10 :D000A98620F4FFE0,4FD
6E18 :00F012A97FC92000,3C3
6E20 :0EC90AF00AC90DF0,3A1
6E28 :06C907F002A90060,2D1
6E30 :057C867D847EA991,440
6E38 :A20120F4FFA903A2,404
6E40 :0720F4FFA996A200,403
6E48 :20F4FF902902F0F4,48A
6E50 :A47CA997A20920F4,41F
6E58 :FFA903A20420F4FF,464
6E60 :A991A20020F4FF80,49F
6E68 :09C007D00568684C,2C1
6E70 :0C6AA57CA67DA47E,3DC
6E78 :60847EB67DA996A2,446
6E80 :0820F4FF902901F0,3CD
6E88 :08A996A20920F4FF,400
6E90 :9810900130A67DA4,340
6E98 :7E60444F574E4C4F,281
6EA0 :4144494E47204D45,215
6EA8 :4E550D3120202052,193
6EB0 :4543454956450D34,1F2
6EB8 :2020205345542042,1AE
6EC0 :6175642052617465,2E6
6EC8 :0D35202020455849,188
6ED0 :5420544F20424153,20D
6ED8 :49430D454E544552,217
6EE0 :204E554D4245520D,1F6
6EE8 :2020555345204354,1EC
6EF0 :524C2D4720544F20,1F5
6EF8 :52455455524E2054,254
6F00 :4F204D454E552029,1ED
6F08 :0D53455420545241,200
6F10 :4E534D4954204261,24E
6F18 :756420526174650D,292
6F20 :4120202037352042,16F
6F28 :6175640D42202033,1FC
6F30 :303020426175640D,209
6F38 :4320313230302042,188
6F40 :6175640D53455420,253
6F48 :5245434549564520,223
6F50 :4261756420526174,2C3
6F58 :650D50524F475241,23D
6F60 :4D20204C4F414445,1F2
6F68 :4420206F680D5052,28D
6F70 :45535320414E5920,213
6F78 :48455920464F5220,210
6F80 :4D454E550D202020,1A2
```

Figure 1. Spectrum.

```
5 REM SPECTRUM 48k        fig 1
10 REM Hex Code Loader
15 CLEAR 59000
20 POKE 23658,8: CLS : PRINT
30 INPUT "Start Address ";a
50 IF a>61135 THEN GO TO 280
60 IF a<60000 THEN GO TO 20
70 PRINT a;
80 INPUT " :";b$
85 IF b$="END" THEN GO TO 280
90 IF LEN b$<>20 THEN GO TO 260
100 LET t=a-256*INT (a/256)
110 FOR n=0 TO 7
120 LET x$=b$(2*n+1 TO 2*n+1)
125 GO SUB 300: LET y=x
130 IF e=1 THEN GO TO 260
140 LET x$=b$(2*n+2 TO 2*n+2)
145 GO SUB 300: LET y=y*16+x
150 IF e=1 THEN GO TO 260
170 POKE a,y: LET a=a+1
180 LET t=t+y: NEXT n: LET y=0
190 FOR m=1 TO 3
200 LET x$=b$(17+m TO 17+m)
205 GO SUB 300: LET y=y*16+x
210 IF e=1 THEN LET a=a-1: GO TO 260
220 NEXT m
230 IF t=y THEN PRINT ":";b$: GO TO 50
240 PRINT "Checksum Error"
250 LET a=a-8: GO TO 50
260 PRINT "Typing Error"
270 LET a=8*INT (a/8): GO TO 50
280 SAVE "download"CODE 60000,1136
290 POKE 23658,0: STOP
300 LET e=0: LET x=CODE x$-48-7*(x$>"9")
310 IF x<0 OR x>15 THEN LET e=1
320 RETURN
```

Figure 2. Spectrum.

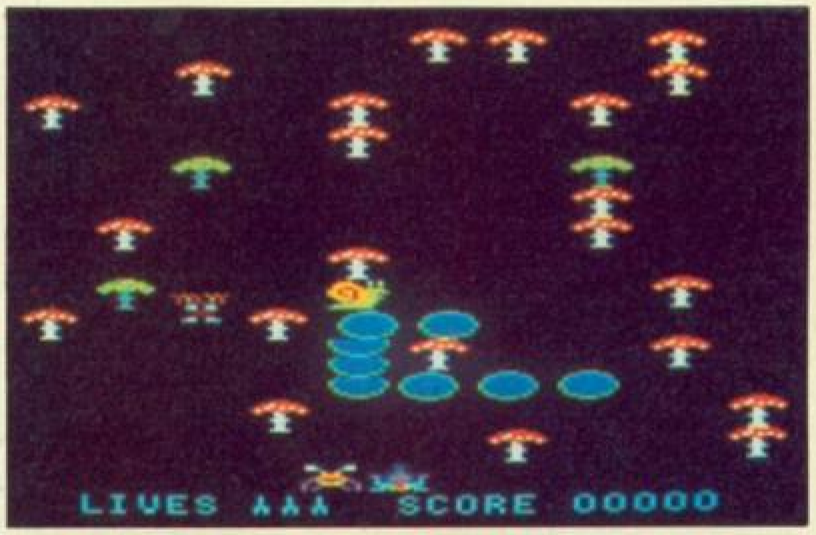
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60000 :CD15EDC307ECCD15,4C7
60008 :EDCD36ECCD66EDCD,631
60016 :50EDCD47EE38FBCD,5AF
60024 :B8EDFE31CA99EAFE,69A
60032 :35CA87EAC366EACD,5D0
60040 :15ED3EFACD84EDCD,5FD
60048 :15EDC9CD15EDC366,553
60056 :EACD66ED11E5EE06,58C
60064 :003EFF121310FCCD,458
60072 :15EE11CDEE06173E,3D2
60080 :20121310FCCD1FED,3DA
60088 :30F0CD50EDCD1FED,588
60096 :30F83265EF3E0032,3E9
60104 :ACEF326FEF3270EF,544
60112 :3A65EFCDEBEC3A65,5A1
60120 :EFE6F0FE0020DE0E,627
60128 :091165EFCD1FEDDA,501
60136 :AAEA1312CDEBEC0D,552
60144 :20F23A69EFE60020,51A
60152 :0021485C3A60EF0E,36C
60160 :0047092260EF0E00,1DA
60168 :11CDEECD1FED309A,47F
60176 :12130CCDEBEC79FE,45C
60184 :1020F03A60EFCD81,447
60192 :ECCD1FEDDAAAEA21,574
60200 :6FEFBE20133E5811,326
60208 :E0EE12133E0012CD,340
60216 :D7ECCDA6ECC3AAEA,681
60224 :CD1FEDDAAAEA2170,518
60232 :EFBE20E121E5EE3A,524
60240 :60EF056F3E000C67,3CC
60248 :3E000E2000CDD7EC,40F
60256 :3E2132005CC3FFE8,482
60264 :3E00326FEF3270EF,3C7
60272 :ED5B60EF0E00CD1F,40C
60280 :EDDAAAEA3273EFCD,634
60288 :E8EC3A60EFFE0020,586
60296 :053A69EFE6003A73,432
60304 :EF12130C3A6AEF89,3FC
60312 :20DCCD1FEDDAAAEA,5D8
60320 :216FEFBEC22DEBCD,584
60328 :1FEDDAAAEA2170EF,5A2
60336 :BEC22DEB3E6F32E2,509
60344 :EE3E6032E3EE3E00,490
60352 :32E4EE3A005CFE21,501
60360 :2003CD15EECDD7EC,553
60368 :CDA6EC21E5EE3A60,5C5
60376 :EF056F3E000C6736,422
60384 :0021E5EEED4B66EF,561
60392 :0C7EFE00C28DEA23,4FC
60400 :0D20F63EFACD84ED,589
60408 :3E01D3FEC366EACD,5E8
60416 :1FED30FBC38DEAF3,594
60424 :0603AFD3FF10FB3E,308
60432 :4003FF3EFFD3FF3E,56F
60440 :31D3FF3E0F320F5C,305
60448 :320D5C32485C3E01,250
60456 :D3FE21915CCD9EF8,560
60464 :CD50EDC366EACD15,52F
60472 :EECD66ED3E01D3FE,556
60480 :2165EE3E00CD0FEC,442
60488 :CD84ECCDA3ECCDA6,654
60496 :EC23CD77ECCD77EC,58F
60504 :CDA0ECCD84ECCDA6,661
60512 :EC233E0DCD0FECCD,4CF
60520 :84EC23CDA3EC3E03,498
60528 :CD0FECCD84ECC9CD,608
60536 :A3EC3E07CD0FECCD,561
60544 :84EC23C97EFE00C8,520
60552 :CD08ED23C384ECFE,651
60560 :00CBF53E20CD08ED,520
60568 :F13DC30FECCDA0EC,65D
60576 :CDA3ECCDA6EC3E0D,5A6
60584 :CD08ED3EFF320C5C,574
60592 :C9F513E6F0C81FC8,60C
60600 :1FC81FC81FF630FE,4CF
60608 :3AFAC6ECC6071213,498
60616 :F1E60FF630FE3AFA,606
60624 :D4ECC6071213C921,46C
60632 :CDEEE5CD84ECE106,69C
60640 :173E20772310FC3E,339
60648 :0077C9E52170EFAE,538
60656 :77C50E007EA7C817,449
60664 :300D7EEE00773A6F,3C9
60672 :EFEE10326FEF3721,305
60680 :6FEFCB1623CB1600,358
60688 :20E2C1E1C9110501,394
60696 :216A00CD0503C93E,32F
60704 :963277EFCD47EDDA,529
60712 :2EEDF1C366EACDAC,5C0
60720 :ED70E601F602D3FE,548
60728 :AF2177EF35200237,2FC
60736 :C9CD77ED30E8C9CD,5F0
60744 :47EED0FEC8C837C9,5E6
60752 :F5D0FF3A81EFFE00,5C7
60760 :20043E3610023E37,187
60768 :D3FFD87FF1C9F53A,675
60776 :81EFFE0020043E36,376
60784 :D3FFCD50EDF1C93E,644
60792 :00D8FFE60037C8D8,59.
60800 :FFE60237C8D8FFE6,626
60808 :302004D87FA7C93A,3E0
60816 :81EFFE0020043E37,397
60824 :10023E36D3FFD87F,452
60832 :C9CD47ED3A73EFD8,5DE
60840 :F1C366EAF53ED23D,5EE
60848 :20FDF1C9CDACED3D,62A
60856 :20FAC9C5D5E5F5FE,780
60864 :7F2013CDF9EDFE0C,537
60872 :200CFE0020053E20,20A
60880 :D73E00D710103E20,34F
60888 :D73E08D73A005CFE,4E0
60896 :2120033E08D73E5F,2E6
60904 :D73E08D7F1E1D1C1,640
60912 :C9FE07201CFECD20,4F3
60920 :19FE0C2014FE0020,380
60928 :10FE0D200CFE20FA,367
60936 :0FEEFE00FA11EE3E,4AA
60944 :00C93E07C9CD6800,32C
60952 :3E02CD01163E1032,1C4
60960 :095CC93E121601CD,382
60968 :1122C93E121600CD,257
60976 :1122C9C5D5E53E02,3E8
60984 :CD0116CD47EE30F8,451
60992 :CD5CEEE1D1C1C93A,5CD
61000 :385CCB6F200C3A08,20F
61008 :5CF521385CCB4EF1,4C3
61016 :A7C937C9F5111000,3DE
61024 :CD18EDF1C9444F57,4D6
61032 :4E4C4F4144494E47,284
61040 :204D454E550D3120,216
61048 :2020524543454956,276
61056 :450D352020204578,217
61064 :697420746F204261,328
61072 :7369630D20205573,2DF
61080 :652053796D626F6C,393
61088 :205368696674202D,380
61096 :204700746F205265,2C9
61104 :7475726E20746F20,39C
61112 :4D454E5520290045,278
61120 :4E544552204E554D,389
61128 :4245522000000000,1C1
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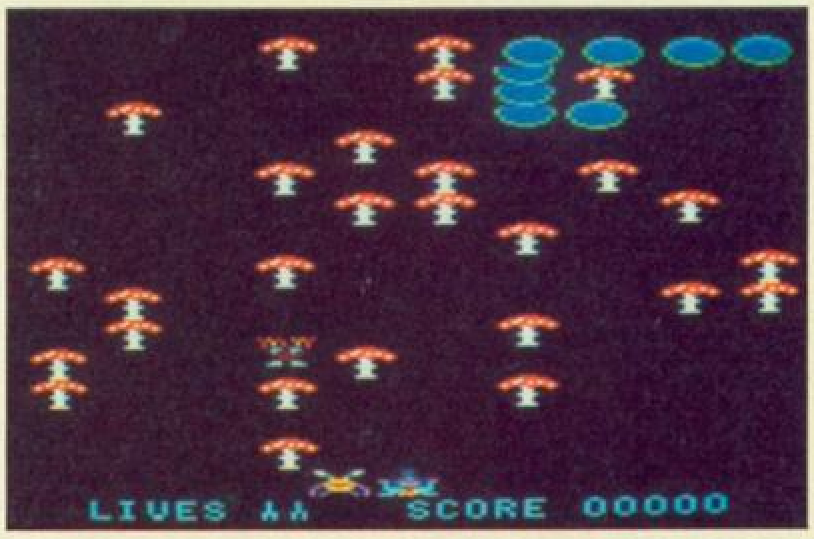
Maggot splat

Ever since the last leak at Windscale your garden has just grown and grown. Ignore all the potting compost and fertiliser adverts, the radio-active nutrients wafting you way beats them hands down and the garden now boasts one of the largest collection of four foot high mushrooms in Europe. The only problem is that the bugs have also grown and some

(continued on next page)

Jason Charlesworth hazes bugs.





Listing 1.

```
 MODE 2:INK 1
,13:PEN 1:PRINT"Assembly in progress,please wait"
10 MEMORY 29999:RESTORE:DIM t(40):FOR a=1 TO 38:READ t(a)
:NEXT a:x=30000
20 FOR a=1 TO 38:t=0:READ a$:IF LEN (a$)<>160 THEN PRINT"
Error in line";110+10*a:END
30 FOR b=1 TO 159 STEP 2:v=VAL ("&"+MID$(a$,b,2)):POKE x,
v:t=t+v:x=x+1:NEXT b:IF t<>t(a) THEN PRINT"Error in line"
;110+10*a;" or Line 110":END
40 NEXT a:PRINT"Completed,no errors found":END
110 DATA 4552,2985,3356,8163,7287,4945,960,7402,10178,746
2,8288,4785,8003,4001,6478,516,2436,7825,8765,8114,10035,
9290,9904,7167,8838,8840,10513,9418,9429,9949,6145,9325,9
404,8417,8863,7984,8671,5823
120 DATA 0000CCCC000000CC64CCCC004498CC64648898CCCCCCCC64
CC8898CC44CC440010200088000010200000000000303000000000010200
0000000102000000000001020000000000030300000000000000000000000
130 DATA 3333000000333C3C3300113C3C3C3C22113C3C3C3C22363C
3C3C3C39363C3C3C3C39363C3C3C3C39113C3C3C3C22113C3C3C3C220
0333C3C3300000033330000000000000000000000000014280000000001428
140 DATA 00000000142800000000078B40000FC14B47828FC0414F0F0
28080043C3C3C3C08040C4C8C0C08000CD89D0C000C086E6E040C00000
000000000000000000000010200000010205524000018AA0000008040000
150 DATA 0000F0F000000050F0F0A00000F8C3C3F40054507080A0A8
A800F0F00054A854000A854A8A8000054540000000000000000000000
00000F0A000AAAA50F0F000222250E1D2A02222F0D2E1F03322F0D2
160 DATA E1F03333F0E1E1F0330050F0E1F0332200F0D2F0B100011
3333330011333333220033333333220000000000000000088A0885050444
45044000A08844504400A0884441C3C3828800086498649000086EB86
170 DATA EB0000C3C3C3C3000041C3C3820000000C3C3000000458A45
8A00000C08040C0000003333000000339133330011623391912262333
33333913322339111331100408000220000408000000000C0C00000
180 DATA 00004080000000000040800000000000408000000000C0C00000
00000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000
190 DATA 000000000000000000000000000000000000000000CD84783E
0332CF8021000022CD80CD9578CD2879CDD27897CDE578CD2280CD19B
DCD3F7ECD667DCDEF7CCD4F7C3E20CD1EBBC018E921000022CD803E
200 DATA 0332CF801803CD1C7ECD8478CD9578CD2879CDD27897CDE5
78CD2280CD237ECD19BDCD717ACD667DCD4F7CCDEF7CCD3F7E3E20CD1
EBB20223AD280FE00200CCD6F78FE0028D9CD587818BBCD1C7ECD3E
210 DATA 783ACF803D32CF8020AFCD1C7EC9211578CDAABCC9010400
00040F0F0600212578CDAABCC901020064000010F0500213578CDAABCC
904030080C02000F1200CDA7BC214F78CDAABC06E1CD19BD10FBC902
220 DATA 0500960000FF1FF216678CDAABC0632CD19BD10FBC90202
00640000FFAFF21D58006087EFEFF20092323232310F53E01C997C92
124B422D38021FF0022D08097320280C921A17811D5800132000EDB0
230 DATA C940000801380000801300000801280000801200000801180000
0110000801080000801000000801FF0C0000FFA8000000FF0000FF3ACF8
0470E19C53E08CD9479C10C0C0C10F4C92ACD80C55F16001922CD80
240 DATA 1110270E3ACD127911E803CD1279116400CD1279110A00CD
127911010 0CD1279C1C9C53EFF3CA7ED5230FA19C609E5CD9479E1C10
C0C0CC997CD0EBC215C7906180E04E5C57ECD9479C10C0C0CE12310
250 DATA F22174799746234E23E5F5CD32BCF1E13CFE1020F0010000
CD38BCC907030206010507070707070707050009040107090909090909070
0000D0D141406061A1A0F0F020208080A0A03030E0E101012121313
260 DATA 1818001A8787875F160021D97919E506C1CDFA7F23DDE106
07DD7E000E02F5E603FE031E0020021E0CFE0220021E08FE0120021E0
473F1E60C1F1F2B0D20DFDD232323CD118010D1C906090808080906
270 DATA 000F08080E08080F000E040404040E00080808080808080F
000E09090E0A09090006090806010906000909090909060600000000
000000000004040404040E0A0A00060909090909090600C040404040E
280 DATA 0006090102040808F0006090102010906000A0A0A0F020202
000F0800E0101090600030408080E0909060000F090102040404000609090
609090600006090907010020C00ED4BD08079FEFF20133E2FCD1EBBC8
290 DATA CD1E78ED4BD3800C0C0C0505050505050578FEBE3032ED43
D080CDFA7FE5CD1180CD11807EE1B62039360CCD1180360CCD1180360
CCD1180CD11803600CD11803600CD11803600C904040404CDFA7F36
300 DATA 00CD11803600CD1180360021FF0022D080C9CD1180CD1180
CD1180CD11803600CD11803600CD11803600ED4BD0802AFB807CB5283
12AF9807DE6FE1F6FCD1B7C2824ED4BF98021000022FB8079E6FE1F
310 DATA 4F3E32CDE578212877CD8E8021FF0022D080CD0E78C92AFF
807CB528192AFD80CD1B7C2811ED4BFD8021000022FF803E32CDE5781
8D02A03817CB528192A0181CD1B7C2811ED4B01812100002203813E
320 DATA 1ECDE57818B0DD21D5803E08F5DD6E00DD23DD66007DFEFF
2819CD1B7C2814DD4600DD2BDD4E00DD3600FFF13E14CDE5781883DD2
3DD23DD23F13D20CFED4BD08079E6F81F1F1F6F7826FFCD0F7F7EFE
330 DATA 00C8E5ED4BD08079E6F81F1F1F4F7826FF24D60C30FB7C87
87478780477987878 74FE17EE6033D200297775F7EE604B3777B87878
047CDFA7F0E040608E536002310FBE1C5CD1180C10D20EF21FF0022
340 DATA D0803E01CDE578CD0E78C97894FE0C300B7995FE0830053E
01FE00C997FE00C9C5ED5BD38079C60793FE0F301078C60B92FE17300
83AD280F60132D280C1C92A03817CB5202ACD72807DFEFAD87CE607
350 DATA 677DE60284678787874F06FF3EFF320581ED4301815C1600
210681192203 81C93A05813CFE0C200197320581ED4B018104ED43018
178FEB5200F210000220381 06B4212877CD8E80C93A0581FE01280A
360 DATA 219876CD307CCD8E80C9110A00197E220381FE0028EA9732
0581C5E505212877CD8E80E1C178C60B4778C60C47110A00197EFE002
0F32203 81ED43018118C12AFF807CB5202ACD72807CFEFFC07DE603
370 DATA C60C6787876F878547 0EFF7C878787848 45F1600210681 19
22FF80ED43FD80C9ED4BFD800C79FE49200F21000022FF800E4821287
7CD8E80C9ED43FD80E607FE01280A210876CD307CCD8E80C9360023
380 DATA 22FF80C5E579C6084F212877CD8E80E1CD2E78C118DDED4B
F9802AFB807CB5202FCD72807CADFEFDC07DE607C6026F87876787844
70EFF7D8787878585 5F1600210681197EFE00C022FB80ED43F980C9
390 DATA 0C79E601FE01200F215076ED43F980A7791F4FCD8E80C979
FE92200F2128770E48CD8E8021000022FB80C9ED43F980E60FFE0420D
32322FB807EFE0028CAE5C579A71F4F3D212877CD8E80C1E179C60C
400 DATA 4FE5C5A7791F4F21E076CD8E80C1E179FE90301179C6104F
3607237EFE0020E122FB80189321000022FB80C921317ECDDDBCC9213
17E113B7E06810EFFCDD7BCC900000 55B500813B7EFF00CD3D7FC9DD
410 DATA 21D5800608C5CD557EDD23DD23DD23DD23C110F1C9DD4E00
DD4601DD5E02DD560379FEFFC87AFE803803041804873D814FC5D5217
875CD8E80D1C11DC2F27E7AFE80381CD57AE60157CD027FD1FE0028
420 DATA 07CD267F1E0C185A1E087AE60157185279FE00201ACD267F
1E0C168178FEB42041212877CD8E8001000011080118 33FE482009CD2
67F1E0C168018E0CD027FFE0020041E08181BFE04300D1E0C7AEE01
430 DATA F68057CD267F180A3EB4905F7AEE01F68057DD7100DD7001
DD7302DD7203CD307CC979E6F81F1F1F82823D6F7826FF24D60C30FB7
C8787878 48485D55F1600210681197ED1C9C5D578C60C47160079C6
440 DATA 084FCD027FD1C1FE00C83600C9CDBC7F7BB2200BED4BD380
21C075CD8E80C9ED4BD380ED43CB807882FEB52003160078FE8B20031
600784779 83FE4938 031E00794FED43D3807BB2C87AFE0028163C28
450 DATA 023E0B8047D5CDDF7FD1FE0028063ACC8032D480ED4BD380
7BFE0028143C28023E07814FCDEA7FFE0028063ACB8032D380ED4BD38
021C075CD8E80C91100003E43CD1EBB2801153E45CD1EBB2801143E
460 DATA 1BCD1EBB28011C3E22CD1EBBC81DC9CDFA7F060897B62310
FCC9CDFA7F060C7EFE00C0CD118010F797C978E6F86F2600295 45D292
91978E607171717F6C04709C97CE638FE382005115 0C819C97CC608
470 DATA 67C906962106813600231 0FB061EC5CD72807DE63CFE3C20
037CE638FE0020057CE628F6044757878 0477CE6074F7DE602815F878
7874F7AA71F6F878785832106811600 5F19360321 3075CD8E80C110
480 DATA BDC9CD0DBD7DAA577CAB5F2A8C802929292919ED5B8C8019
228C80C90DF0E578E6F86F2600295 45D29291978E607171717F6C0470
9D1060CC5EBD59712130106 00EDB012D1EB7CE638FE382006015 0C8
490 DATA 0918047CC60867C110DEC9408CAC04004 33E01408CFF6C07
00FF9C0301FF6C0800047840700FF6C0100FF6C0600FF6C0200357803 0
100000801455451813 7B4A381209B8C810B0000000000000000000000
```

Maggot Splat



(continued from previous page)

of them are a bit vicious. Never mind you think, you can use your world famous Haze gun — Hurt and Zap 'Em — on them and rid your beautiful garden of all those horrible creepy crawlies.

So the scene is set for an epic show down of man against bugs in this game for the Amstrad. In the game you control the laser base at the bottom of the screen and may move in all directions in your efforts to remove the maggot from the garden. The maggot is however incredibly thick and even though you shoot it, it doesn't realise it's dead but instead splits up and each segment has its it own life. Thus you must shoot each section of the maggot. This task is hampered by the other creatures in the garden. There are also spiders, fleas, and snails.

Shots worth 50 points

Fleas simply drop from above and if they encounter a mushroom, they jump over it. Spiders generally stay away from the laser base but if they hit a mushroom, they poison it so when a maggot hits it the maggot plumets down dead. The touch of any of these creatures is deadly.

For each snail shot you get 50 points, each spider is worth 50, each flea is worth 30 and each section of the maggot is worth 20. Mushrooms may be shot and each section of mushroom is worth 1 point.

This game is written in machine code and so features very smooth graphics which in the case of the laser base is interrupt driven to give an extra smoothness. The game may be played with either keyboard or joystick.

To set the game, type in listing 2 and save it to tape with SAVE "MAGGOTS"

Next type in listing 1 and run it. If an error is found, correct the error and re-run the program. Repeat this until no errors are found and then save machine code to tape directly after "Maggots with SAVE 'CODE",b,30000,4000

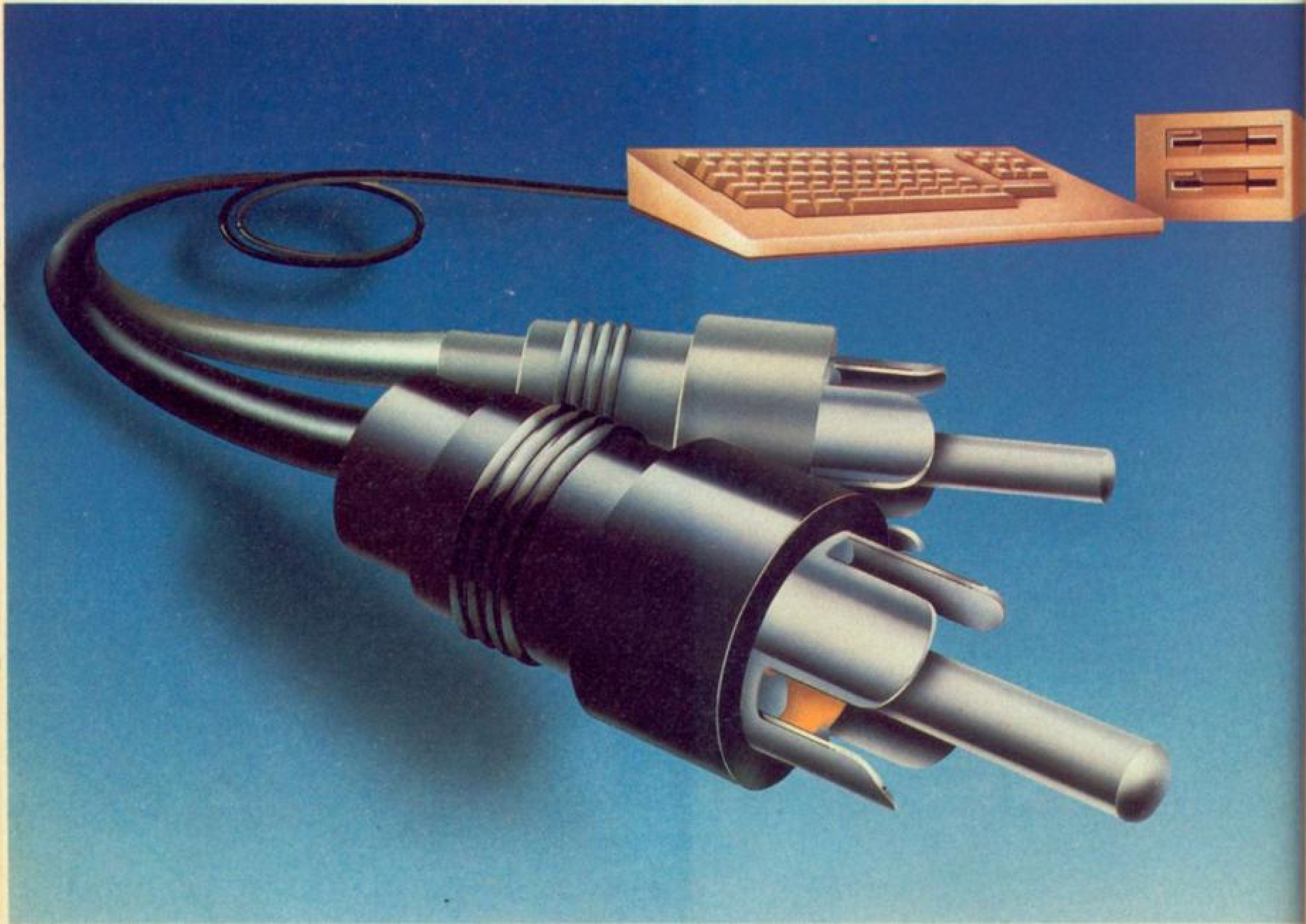
The game may now be run and loaded from the tape with RUN "MAGGOTS"

Listing 2.

```
10 ENV 5,15,1,1
20 ENV 1,5,3,1,5,-2,1,1,Ø,4,5,-1,1
30 ENV 2,5,3,1,5,-3,2
40 ENV 4,5,3,1,5,-2,1,5,-1,2
50 ENV 3,5,1,1,3,3,1,3,-3,1,5,-1,1
60 DIM n$(6),n(6):FOR a=1 TO 6:READ n$(a),n(a):NEXT
70 MEMORY 29999
80 PEN 1:MODE Ø:PRINT"   PLEASE WAIT":LOAD "!"
90 INK Ø,Ø:INK 1,26:INK 2,2Ø:INK 3,6:INK 4,21:BORDER Ø
100 PEN 1:MODE Ø:PRINT"    MAGGOT SPLAT":PRINT:PEN 2:PRIN
T"  By J.Charlesworth"
110 PEN 3:LOCATE 8,8:PRINT"Ø  Abort"
120 PEN 4:LOCATE 8,1Ø:PRINT"Q  Up":LOCATE 8,12:PRINT"A  D
own"
130 LOCATE 8,14:PRINT"O  Left":LOCATE 8,16:PRINT"P  Right
"
140 PEN 2:LOCATE 4,18:PRINT"Space  Fire"
150 PEN 1:LOCATE 4,2Ø:PRINT"Or use joystick"
160 PEN 4:LOCATE 4,23:PRINT"Press J for Joystick    or K
for Keys"
170 a$=INKEY$:IF a$="j"OR a$="J" THEN POKE 327Ø4,72:POKE
32712,73:POKE 32728,74:POKE 3272Ø,75:POKE 31355,76:GOTO 2
ØØ
180 IF a$="k"OR a$="K" THEN POKE 327Ø4,67:POKE 32712,69:P
OKE 32728,34:POKE 3272Ø,27:POKE 31355,47:GOTO 2ØØ
190 GOTO 17Ø
200 CALL 3Ø633:sc=PEEK(32973)+256*PEEK(32974)
210 FOR A=Ø TO 5Ø:a$=INKEY$:NEXT
220 FOR a=1 TO 6:IF sc>n(a) THEN GOTO 28Ø
230 NEXT a
240 MODE Ø:PEN 2:PRINT"   Hi Score Table":FOR a=1 TO 6:LO
CATE 2,4+2*a:PEN a+1
250 PRINT n$(a):LOCATE 13,4+a*2:PRINT n(a):NEXT a
260 FOR a=Ø TO 25ØØ:IF INKEY$="" THEN NEXT a
270 GOTO 9Ø
280 IF a<>6 THEN FOR b=5 TO a STEP -1:n$(b+1)=n$(b):n(b+1
)=n(b):NEXT b
290 n(a)=sc:LOCATE 1,25:PRINT"                   ";:LOCAT
E 1,25:INPUT "Name ";n$(a)
300 GOTO 24Ø
310 DATA Jetman,1ØØØ,Hippo,8ØØ,Shaggy,6ØØ,Scooby,4ØØ,Gree
n Sofa,2ØØ,Zarquon,1ØØ
```


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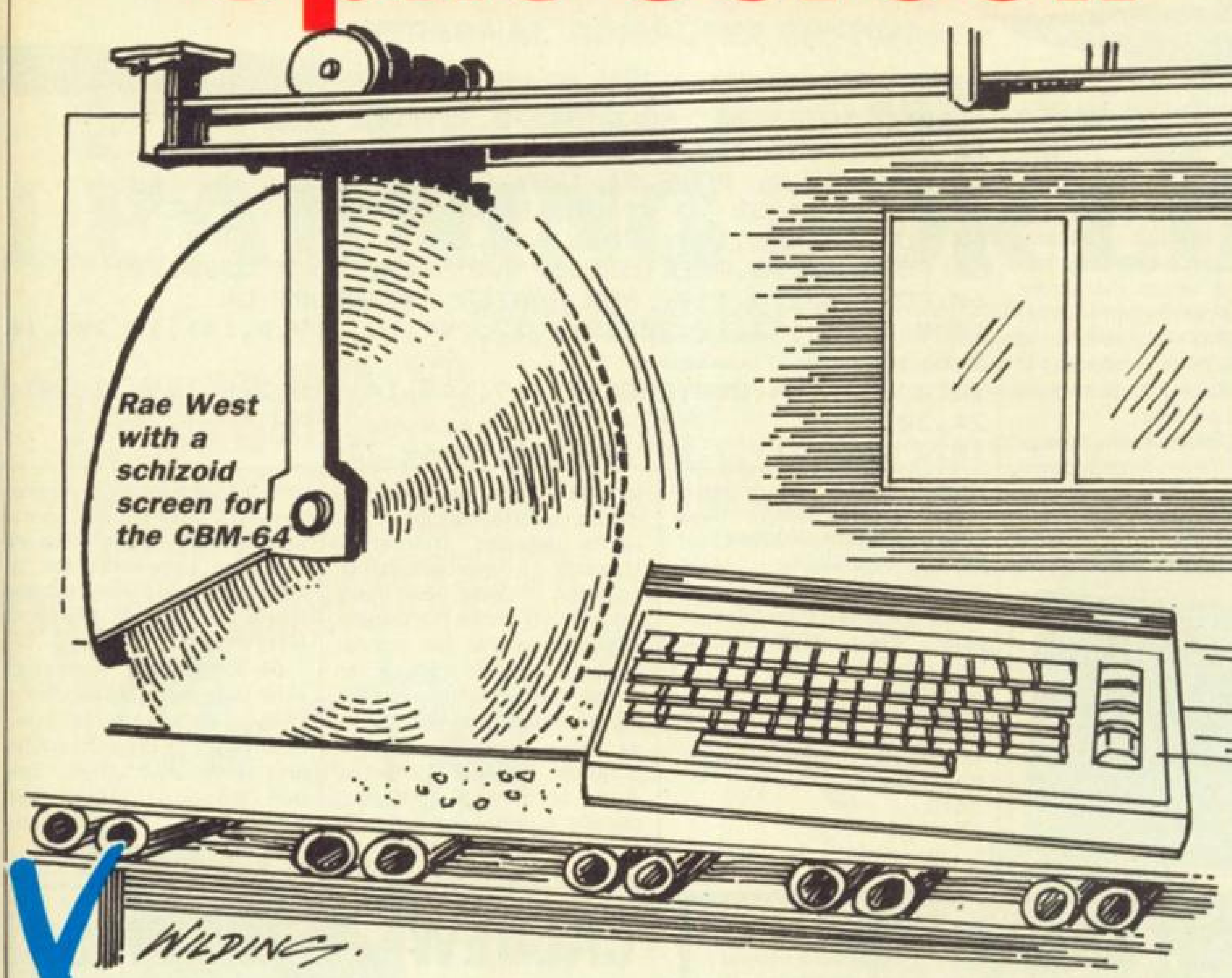
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Split-screen



Rae West with a schizoid screen for the CBM-64

You've probably seen adventure games with scrolling text in a few lines at the bottom of the screen, and some sort of picture at the top. Often this effect is produced by dividing the screen horizontally in two parts, with the screen taking part of its information from one display, ordinary text in our example game, and part from another — bitmapped or user-defined graphics characters.

We're not talking here about windows or pop-up menus; these have to be programmed by moving stored-up portions of Ram into the screen, and the overwritten parts have to be stored elsewhere or reprinted. Nor are we discussing the simpler effects where, typically, the border of the screen appears as erratic colured bands, and true interrupts aren't used.

Splitscreen graphics rely on the fact that the screen is scanned from top to bottom 50 times a second or so; the computer is fast enough to be able to take time off its normal tasks to alter the screen's parameters regularly at every scan.

Assembly language listing.

```
INT   C000  LDA  D012   ;Read raster line
      C003  CMP  £$50   ;Comparison decides whether
                        top or bottom
      C005  BCC  TOP    ;Branch if at top of screen
      C007  LDA  £$00
      C009  STA  D012   ;Next interrupt will be at scan
                        line 0
      C00C  LDA  £$05
      C00E  STA  D018   ;Reset screen to start at 32768
      C011  BNE  EXIT   ;Exit
TOP   C013  LDA  £$91
      C015  STA  D012   ;Next interrupt at line 145 —
                        about midscreen
      C018  LDA  £$15
      C01A  STA  D018   ;Reset screen to start at 34816
EXIT  C01D  LDA  £$01
      C01F  STA  D019
      C022  JMP  EA31   Exit to normal keyboard
                        reading routine
```

Raster interrupts

Raster interrupts: VIC-II is a chip controling TV output. These are the relevant locations for us:

D013's high bit is bit 8 of the raster scan line.

D012 = 8 lower bits of the scan line; so the maximum range is 0-511. When read, these registers show which screen line is being processed; writing to them sets an interrupt point.

DO1A sets various Interrupts and clears the corresponding flags after an interrupt. We're interested in bit 0; setting this high will cause an interrupt to occur when the TV scan line matches the value put into the two registers above.

D019's bit 0 must be cleared if we wish to cause further interrupts.

Interrupts are used by the 64 to read the keyboard; we'll have to add our own routines. This sort of thing is typical: (i) in Basic, we use POKE 56333,127 to turn off the ordinary, time-controlled interrupts.
POKE 788,0: POKE 789,192 redirects interrupts to $C000 (49152), the 64's free area of Ram. Then, after adding a routine at $C000,
POKE 53274,129 turns raster interrupts on.

"Your Computer", June '85, has my article listing all screen positions avalable on the 64. They are controlled by the contents of DD00 (56576), D018 (53272) and $288 (648). To keep things simple, we'll use two screens, one starting at 32768, the other at 38912. These positions, unlike most others, allow VIC-II to use the inbuilt character set without the need to move it around in memory. However, we do have to poke the top of Basic to prevent it overwriting the screens.

Another actor in the drama is colour Ram: a single block of memory (D800-DBE7) which controls the principal colour in

(continued on next page)

Split-screen

(continued from previous page)

each character of 8 by 8 dots. The fact that only one block is available can cause problems.

If your'e experienced in 6510 machine langauge, you'll be able to follow how the interrupt handling routine separates incoming inturrupts into two types, and swaps the screen position depending on whether the line being scanned is at the top of the screen or midway. If you don't know ML, just try the Basic version later.

Type in this program, Save it, and Run. (Note: Stop-Restore, then Run 1, will get you back to normal in emergency).

POKE 56576, 149 combined with the interrupt's pokes into D018 (=53272 in decimal) make the screen switch, so the bottom half starts at 32768, and the top half starts at 34816 Now. POKE 648,128 causes Basic to write to the first of these, while POKE 648,132 writes to the second.

```
0 GOTO 10
1 POKE 56576,151: POKE
53272,23: POKE 648,4: END
10 POKE 56333,127: POKE 788,0:
POKE 789,192:
...ETC...
1020 DATA 169,1,...
```

This article is just an introduction to the technique: there's insufficient space for really detailed treatment. However, the approach can be extended without too much trouble to increase the number of sprites above the normal meagre, eight by splitting the screen into several zones — *Programming the Commodore 64* has a specimen 32-sprite program, number 12-34 on disc), or to mix bitmapped pictures with text (on disc too).

The technique is quite attractive because of its elegance — very little processing time is used up, and effects which are otherwise impossible can be achieved. Some programmers love it — like Jeff Minter of furry animals fame.

64 Roms vary somewhat: older Rom machines handle the space (blank) character differently, so the colour Ram area shows odd effects. You may find you 64, with an older Rom, doesn't run the Basic program very successfully.

Rae West has written a 600 page reference book. *the Programming Commodore 64*, recently published by level Ltd. It is obtainable from Biblos Distribution, Star Road, Nr Partridge Green, Horsham, W. Sussex at £14.90 plus £1 post.

Demo program

```
0 GOTO 10
1 POKE 56576,151:POKE 53272,23:POKE 648,4:END
10 POKE 56333,127: POKE 788,0: POKE 789,192
20 POKE 55,0: POKE 56,128: CLR
30 FOR J=49152 TO 49188: READ X: POKE J,X: NEXT
40 POKE 56576,149: POKE 648,128
50 POKE 53265,PEEK(53265) AND 127: POKE 53266,0
60 POKE 53274,129: REM RASTER INTERRUPT ON
1000 DATA 173,18,208,201,72,144,12,169,0,141,18,208,16
9,5,141
1010 DATA 24,208,208,10,169,145,141,18,208,169,21,141,
24,208
1020 DATA 169,1,141,25,208,76,49,234
```

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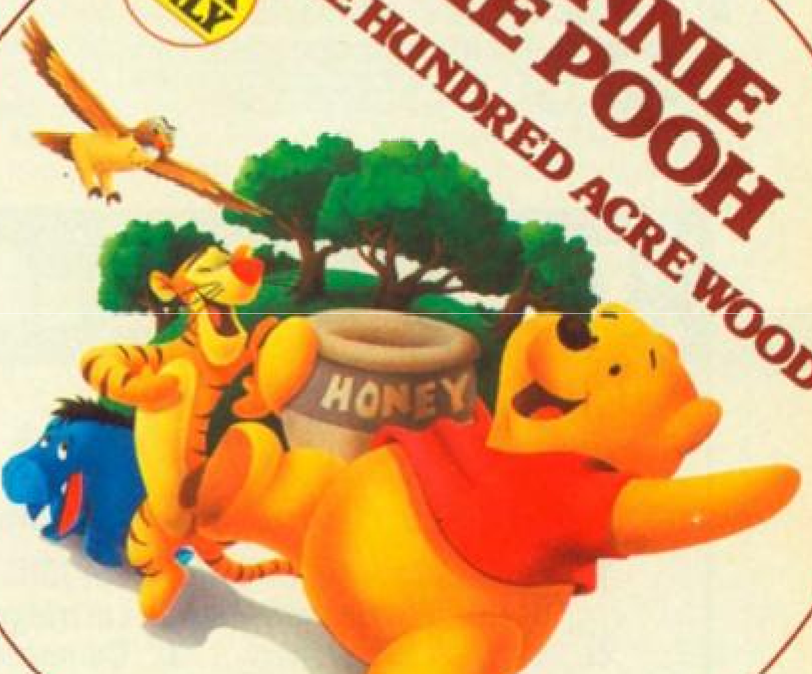
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Disc Cat

Fintan Culwin sorts out BBC discs

I was mildly embarrassed recently when a friend offered me some non-copyright programs. Instead of the usual muddle of discs they were neatly arranged and numbered in a box on a shelf. What was intriguing was that he had a card index itemising each file and the disc it could be found upon.

The embarrassment came a few weeks later when he returned the visit. Offering to repay the programs in kind I performed my usual scramble through the pile of discs on my shelf and madly started to *Cat them hunting for the file I was looking for.

Card indexes are not for me, the main reason being that I cannot organise myself efficiently enough to update them. But possibly more importantly I don't possess massive stocks of computer equipment for it to sit idly by while I fill out forms.

The specification for this program came from this experience. what I wanted was a program which would allow me to insert the discs one at a time. After inserting the disc I would have the option of rejecting some of the files. The remainder would be filed somehow. When all the discs had been processed, it would be possible to produce a printed listing of the information.



This program is available on the Telsoft service.



Considering the problem further, it would have to be possible to add to this list as my collection of discs grew, rather than recatalogue the entire file. If a file grew, for example the new information would have to overwrite the old information rather than have it entered as a separate entry.

To accommodate this I would have to give each disc in my collection a name and a number. The first part of the printout would be an ordered list of the discs and their titles. The second part would be a list of the files in alphabetical order, together with the number of the disc that they could be found upon and the filing system information contained upon them.

This seemed simple enough for me to manage. So, satisfied that I could accommodate my ways to the system and that the system would satisfy my needs, I started the detailed planning stage.

The first and simplest problem concerned the storage of the information. With even a moderate collection of full discs it would probably be impossible to hold all the information in the computer's memory and manipulate the information at the same time. So the information would have to be filed on disc and manipulated there.

The second problem was how

(continued on page 93)

Listing 1.

```
10REM FILE CAT VERSION 1
20PROC_initialise
30REPEAT
40PROC_catalogue
50UNTIL done
60PROC_printout
70STOP
80DEF PROC_initialise
90CLOSE #0
100DIM code% 100
110REM space for machine code routine
120DIM data% 1240
130REM space for result of *INFO call
140channel = OPENUP("filecat")
150IF channel = 0 THEN channel = FN_make_file
160CLOSE #channel
170OSCLI = &FFF7
180*FX 4,1
190PROC_assemble
200done = FALSE
210ENDPROC
220DEF FN_make_file
230REM produce file with default header
240LOCAL channel
250channel = OPENOUT("filecat")
260FOR loop = 1 TO 66
270BPUT #channel,&00
280NEXT loop
290PTR # channel = 2
300BPUT #channel,0:BPUT # channel , 0 : BPUT # chann
el,0: BPUT #channel ,2 : BPUT #channel ,0
310REM first disc number null.null.null & No. of rec
ords 2
320PTR#channel = 0:BPUT #channel, &FF:BPUT #channel,
&FF
330REM fist disc title pointer null
340PTR #channel = 33
350BPUT # channel, &FF:BPUT # channel, &FF
360REM first filename pointer null
370= channel
380DEF PROC_assemble
390FOR opt = 0 TO 3 STEP 2
400P% = code%
410[ OPT opt
420LDA #(data% MOD 256)
430STA &71
440LDA #(data% DIV 256)
450STA &72
460\ base address for characters returned
470LDA &20E
480STA orvec
490LDA &20F
500STA orvec + 1
510\ preserve original vector
520LDA #(revec MOD 256)
530STA &20E
540LDA #(revec DIV 256)
550STA &20F
560\ install new vector
570LDX #(star_drive MOD 256)
580LDY #(star_drive DIV 256)
590JSR OSCLI
600\ *DRIVE command
610LDX #(star_info MOD 256)
620LDY #(star_info DIV 256)
630JSR OSCLI
640\ *INFO command
650LDA orvec
660STA &20E
670LDA orvec + 1
680STA &20F
690RTS
700\ restore original vector and return
710.orvec NOP : NOP
720.star_drive
730]
740$P% = "DRIVE 0 "
750drive% = P% + 6
760P% = P% + 8
770[ OPT opt
780.star_info
790]
800$P% = "INFO *.*"
810P% = P%+10
820[ OPT opt
830.revec
840\ vectored code starts here
850STA &70
860TYA
870PHA
880LDY #0
890LDA &70
900\ preserve and zero Y register
910STA (&71),Y
920\ store character at address in &71/2
930INC &71
940BNE no_need
950INC &72
960\ increment adress in &71/2
970.no_need
980PLA
990TAY
1000LDA &70
1010RTS
1020\ restore Y and return
1030]
1040NEXT opt
1050ENDPROC
1060DEF PROC catalogue
1070CLS
1080FOR line% = 0 TO 1
1090PRINTTAB(16,0+line%)CHR$(141)"Disc Cat"
1100PRINTTAB(5,3+line%)CHR$(141)"Drive : "
1110PRINTTAB(2,5+line%)CHR$(141)"Disc No. : "
1120PRINTTAB(0,7+line%)CHR$(141)"Disc Title : "

1130NEXT line%
1140REM format screen
1150disc$ = FN_getin(13,4,1,TRUE)

1160disc_no$ = FN_getin(13,6,3,TRUE)
1170disc_title$ = FN_getin(13,8,24,FALSE)
1180IF LEN(disc_no$) <> 3 THEN disc_no$ = STRING$(3-L
EN(disc_no$),"0")+disc_no$
1190IF disc_no$ = "999" THEN done = TRUE : ENDPROC
1200REPEAT
1210IF VAL(disc$) > 3 THEN disc$ = FN_getin(13,4,1,TR
UE)
1220UNTIL VAL(disc$) < 4
1230?drive% = ASC(disc$)
1240PROC_change
1250REM get and verify users inputs
1260CALL code%
1270REM activate machine code routine
1280no_files = FN_display_all
1290REM display filenames
1300PROC_change
1310PROC_select(no_files-1)
1320REM select files to be excluded
1330CLS
1340PROC_fileit
1350REM file information
1360ENDPROC
1370DEF FN_getin(x,y,len,nums)
1380REM routine to accept keyboard input
1390REM in double heigth: x,y position
1400REM len - maximum length, nums - numbers only fla
g
1410temp$ = STRING$(len," ")
1420PRINTTAB(x,y-1)temp$
1430PRINTTAB(x,y)temp$
1440PRINTTAB(x,y);
1450got = 0
1460get$ = ""
1470REM blank out screen and get ready
1480REPEAT
1490key = GET
1500valid = FN_check(key,nums)
1510IF key = 127 AND got > 0 THEN PROC_delt
1520UNTIL key = 13
1530= get$
1540DEF PROC_delt
1550REM double height delete
1560got = got -1
1570get$ = LEFT$(get$,got)
1580VDU127,11,32,10,8
1590ENDPROC
1600DEF FN_check(key,nums)
1610REM check key press against flag and length
1620IF key = 127 OR (got = len AND key <> 13) THEN =
FALSE
1630lower = 47 : upper = 123
1640IF nums THEN upper = 58
1650valid = FALSE
1660IF key > lower AND key < upper THEN got = got + 1
:valid = TRUE
1670IF valid THEN VDUkey,11,8,key,10 :get$ = get$+CHR
$(key)
1680IF key = 32 AND NOT(nums) THEN VDU32:got = got +
1 : get$ = get$ + " "
1690= valid
1700DEF FN_display_all
1710REM display filenames from *INFO call
1720top_data = ?&71 + 256*?&72
1730REM top of list provided by machine code section
1740no_files = (top_data - data%)/40
1750REM 40 characters per filename
```

(continued on page 93)



Disc Cat

(continued from page 91)

to extract the information about the catalogue from the disc. Perusing my copies of the BBC's OS guides it seemed possible but tedious to obtain the information by making a series of system calls — the first to obtain the disc catalogue and subsequent calls for each file in the catalogue. The official way however is not always the most elegant. One official call, *Info*.*, would yield the required information but display too much of the information on the screen, and with a full directory overflow one full screen.

It is here where the wonderful flexibility of the BBC's operating system came to the rescue. Issue the *Info call and trap the information returned before it gets to the screen. Specifically direct it to a reserved area of memory, where the filenames can be extracted for display on the screen and the rest of the information held available for filing. It is possible to do this as most operating system routines are vectored through the user Ram, allowing them to be trapped.

Having written and tested this part of the program, I then started to consider in more detail the structure of the file which would contain the information. As the size of the file was indeterminate, and the information had to be presented in a certain order, it seemed sensible to maintain an ordered file.

There are two choices when doing this. The most obvious way would be to hold an ordered list of disc titles, followed by an ordered list of filenames. Simple to understand but difficult to implement.

If a new disc or filename had to be added to the list it would result in a great deal of shuffling of information on the disc. The second method of storing an ordered list is more difficult to understand and code but much easier to implement on a filing system.

The information is physically stored in the sequence it is collected in. Associated with

Figure 1. Details of a double entwined linked list

(a) before addition of file BBBBBBB

Record number	Pointer	Information
1	3	dummy (start of titles list)
2	4	dummy (start of filenames list)
3	7	title of disc # 1
4	5	filename AAAAAAA
5	8	filename CCCCCCC
7	0	title of disc # 2 (and end of list)
8	0	filename DDDDDDD (and end of list)

(b) after addition of file BBBBBBB

Record number	Pointer	Information
1	3	dummy (start of titles list)
2	4	dummy (start of filenames list)
3	7	title of disc # 1
4	9	filename AAAAAAA
5	8	filename CCCCCCC
7	0	title of disc /2 (and end of list)
8	0	filename DDDDDDD (and end of list)
9	5	filename BBBBBBB

(continued on next page)

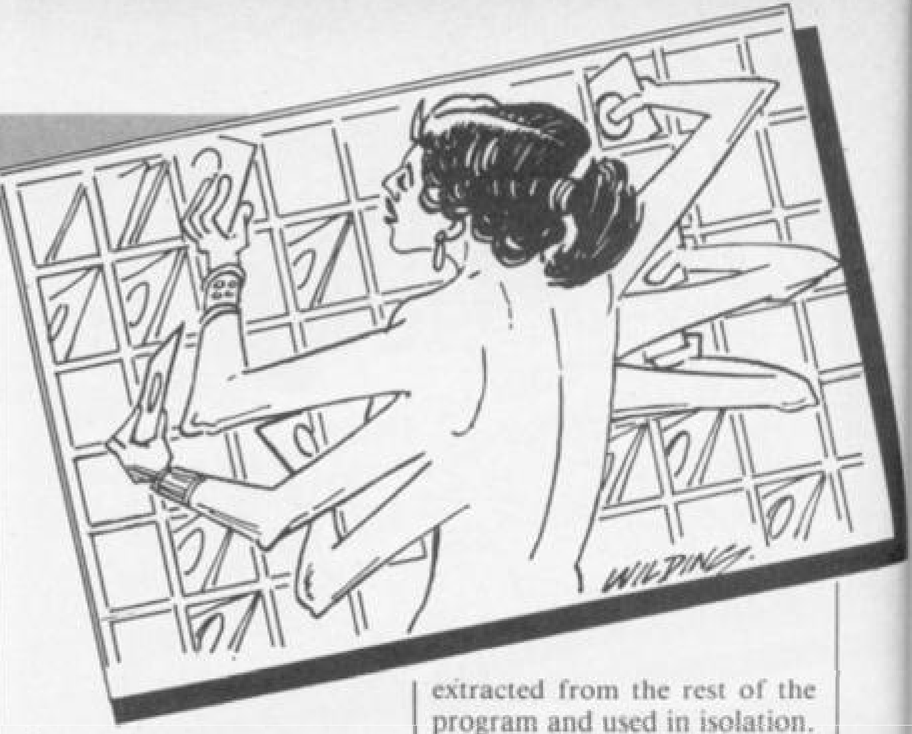
(listing continued from page 91)

```
1760FOR loop = 0 TO no_files-1
1770filename$ = FN_get_name(loop)
1780y = (loop DIV 3) + 10
1790x = 3 + (loop MOD 3)* 13
1800PRINTTAB(x,y)filename$
1810REM formatted three across
1820NEXT loop
1830= no_files
1840DEF FN_get_name(ordinal)
1850REM return filename from memory
1860address = data% + (ordinal) *40
1870lenf = 0 : temp$ = ""
1880REPEAT
1890temp$ = temp$ + CHR$(?address)
1900lenf = lenf + 1
1910address = address + 1
1920UNTIL lenf = 10 OR ?(address) = 32
1930= temp$
1940DEF PROC_change
1950PRINTTAB(0,23)CHR$(136)"CHANGE DISC - PRESS SPACE
TO CONTINUE";
1960REPEAT
1970key = GET
1980UNTIL key = 32
1990PRINTTAB(0,23)STRING$(39," ");
2000ENDPROC
2010DEF PROC_select(max)
2020REM selects files from list for inclusion/exclusi
on
2030pos = 0
2040on$ = "]" : off$= "["
2050PRINTTAB(1,10)on$
2060PRINTTAB(14,10)off$
2070REM start with first filename
2080REPEAT
2090key = GET
2100IF key = 139 THEN PROC_MOVE(-1)
2110IF key = 138 THEN PROC_MOVE(1)
2120REM up/down arrow keys
2130IF key = 127 THEN PROC_smudge(pos)
2140REM delete key
2150UNTIL key = 13
2160ENDPROC
2170DEF PROC_MOVE(dir)
2180REM move from one file to next
2190IF (dir = -1 AND pos = 0) OR (dir = 1 AND pos = m
ax) THEN ENDPROC
2200y = (pos DIV 3) + 10
2210x = 1 + (pos MOD 3) * 13
2220PRINTTAB(x,y)" ":PRINTTAB(x+12,y)" ";
2230REM unmark current file
2240pos = pos+dir
2250y = (pos DIV 3) + 10
2260x = 1 + (pos MOD 3) * 13
2270PRINTTAB(x,y)on$ : PRINTTAB(x+12,y)off$
2280REM mark next file
2290ENDPROC
2300DEF PROC_smudge(pos)
2310REM mark a file as excluded/included
2320address = data% + pos*40
2330REM first character fo filename
2340y = (pos DIV 3) + 10
2350x = 2 + ( pos MOD 3) * 13
2360IF (?address AND &80) = 0 THEN PROC_remove(42,42)
ELSE PROC_remove(32,32)
2370REM flagged by high bit, either mark for exclusio
n or remove marks
2380?address = ?address EOR &80
2390REM change flag
2400ENDPROC
2410DEF PROC_remove(on,off)
2420REM sets or removes deleted markers
2430PRINTTAB(x,y)CHR$(on) : PRINTTAB(x+10,y)CHR$(off)
2440ENDPROC
2450DEF PROC_fileit
2460REM file disc title and files from call
2470channel = OPENUP("filecat")
2480PROC_filename
2490REM title
2500PROC_filenames
2510REM files
2520CLOSE #channel
2530ENDPROC
2540DEF PROC_filename
2550REM file disc title
2560extent = FN_extent
2570REM returns length of file
2580ptr% = 0: old_ptr% = ptr%
2590REPEAT
2600last_ptr% = old_ptr%
2610old_ptr% = ptr%
2620PTR #channel = ptr%
2630ptr% = BGET #channel + 256 * BGET # channel
2640REM follow chain of pointers
2650this_no$ = CHR$(BGET#channel)+CHR$(BGET#channel)+
CHR$(BGET#channel)
2660this_title$ = "" : len = 0
2670REPEAT
2680byte = BGET # channel
2690IF byte <> &FF THEN this_title$ = this_title$ + C
HR$(byte) : len = len + 1
2700UNTIL byte = &FF
2710REM recover information
2720UNTIL disc_no$ <= this_no$ OR ptr% = &FFFF
2730REM either disc number exceeded or chain ended
2740IF this_no$ =disc_no$  THEN PROC_no_change
2750IF disc_no$ > this_no$ THEN PROC_append ELSE PROC
_insert
2760ENDPROC
2770DEF FN_extent
2780REM returns length of file in characters
2790PTR #channel = 5
2800records = BGET#channel + 256*BGET #channel
2810= 33 * records
2820DEF PROC_no_change
2830REM disc numbers match
2840IF this_title$ = disc_title$ THEN ENDPROC
2850PTR #channel = ptr%+5
2860FOR loop = 1 TO LEN(disc_name$)
2870BPUT #channel,ASC(MID$(disc_name$,loop,1))
2880NEXT loop
2890BPUT #channel, &FF
2900REM overwrite title and end marker
2910ENDPROC
2920DEF PROC_insert
2930REM insert disc title into chain
2940PTR # channel = last_ptr%
2950BPUT # channel, extent MOD 256
2960BPUT # channel, extent DIV 256
2970REM set last pointer to current eof
2980PTR #channel = extent
2990BPUT #channel,old_ptr% MOD 256
3000BPUT #channel,old_ptr% DIV 256
3010REM at current eof write existing pointer
3020PROC_store_name
3030REM followed by rest of info
3040ENDPROC
3050DEF PROC_append
3060REM append title to list
3070PTR #channel = old_ptr%
3080BPUT #channel,extent MOD 256
3090BPUT #channel,extent DIV 256
3100REM set last pointer to eof
3110PTR # channel = extent
3120BPUT #channel,&FF
3130BPUT #channel,&FF
3140REM at current eof write nulls
3150PROC_store_name
3160REM followed by new information
3170ENDPROC
3180DEF PROC store_name
3190REM store new disc title
3200temp$ = disc_no$+disc_title$+CHR$(&FF)
3210FOR loop = 1 TO LEN(temp$)
3220BPUT #channel,ASC(MID$(temp$,loop,1))
3230NEXT loop
3240PROC_added_1
3250REM increase no of records
3260ENDPROC
3270DEF PROC added_1
3280REM increment record counter on file
3290PTR #channel = 5
3300BPUT # channel, (records+1) MOD 256
3310BPUT # channel, (records + 1) DIV 256
3320ENDPROC
3330DEF PROC_filenames
3340REM  process filenames from the disc
3350VDU 15
3360REM ensure screen can scroll
3370f_ptr% = data%
3380REPEAT
3390IF (?f_ptr% AND &80) = 0  THEN PROC_do_one
3400REM ignore files with first high bit set
3410f_ptr% = f_ptr%+40
3420UNTIL f_ptr% >= top_data
3430ENDPROC
3440DEF PROC_do_one
3450REM process one filename
3460full_name$ = ""
3470FOR loop = 0 TO 9
3480full_name$ = full_name$ + CHR$(f_ptr%?loop)
3490NEXT loop
3500full_name$ = full_name$ + disc_no$
3510FOR loop = 14 TO 34
3520char$ = CHR$(f_ptr%?loop)
3530IF char$ <> " " THEN full_name$ = full_name$ + ch
ar$
3540NEXT loop
3550small_name$ =  MID$(full_name$,3,8)
3560REM full_name$ includes $.ABCDEFG plus disc numbe
```

(listing continued on next page)

Disc Cat

(continued from previous page)



each item of information on record is a pointer to the next item of information in sequence. To add a new record and preserve the sequence you only have to change two pointers.

Such a structure is called a linked list. In this application two such lists are required, one for the disc titles and one for the filenames. A simple picture of a small linked list is shown in figure 1a and 1b. To add filename BBBBBBB to the list in 1a, you need only write the information at the end of the file with its pointer pointing to record 5, and rewrite the pointer in record 4 to point to the new record.

Using this idea, the program keeps a 33-byte record. The first two bytes are the record pointer. For a disc title the next three characters indicate the disc number in Ascii, and the disc title follows terminated by &FF. Following the pointer there is the filename. This is always nine bytes long padded out by spaces if necessary. The filename is followed by its disc number as above and 12 further bytes giving the load address, excursion address and size of file.

The first two records are dummies used to start the disc titles chain and the filenames chain respectively. Bytes 5 and 6 of the first record are also used to indicate the current length of file in records.

The utility operation is straightforward. It starts by asking for the drive to be entered, the disc number and the disc name. When these have been verified you are invited to insert the disc to be processed. You're given a list of files and a chance to switch discs back. On a dual-drive system, switch the disc in and out of the second drive.

A file on the display is highlighted by a pair of arrows on the screen. The highlighted file can be changed using the up and down arrow keys. A file can be deleted from consideration using the delete key. A deleted file is shown enclosed by stars, (*). A deleted file which is highlighted can be restored by using the delete key again.

When all is to your satisfaction press Return to start filing the details. As each file is processed its name is shown on the screen. A side-product of this program should be a testing of your disc system.

After all the filing has been done, the screen reverts to asking for drive number, disc number and title. More discs can thus be processed in one session. To conclude the session enter the disc number as 999.

The print routine starts by asking for a catalogue title and a date reference. To skip the printout, enter "none" as the catalogue name. The catalogue will be presented as a list of discs and titles in numeric order, followed by the list of filenames in alphabetic order. The list is paged with headings, footings and a page count. Two printer control codes can give details.

The printout routine can be extracted from the rest of the program and used in isolation. Apart from one part it is all contained in the final section of the program starting with PROC-printout. Add to this FN-getin, PROC — delt and FN-ceak and the routine can be applied in isolation. Alternatively for additional copies of the catalogue load the whole program and type PROC-printout from the keyboard.

One final and rather important point. As new files are added the catalogue file Filecat has to grow. To avoid "can't extend" errors, and preserve your data in case of filing system accidents, take a blank disc, copy the Filecat program and the current Filecat file to it, in that order.

(listing continued from previous page)

```
r plus *INFO details
3570REM small_name$ = $.ABCDEFG
3580mid_name$ = MID$(full_name$,1,13)
3590REM mid_name$ includes $.ABCDEFG plus disc number

3600choice = FN_one_filename
3610PRINT " doing ";mid_name$;TAB(28)"...."
3620PROC_file_file(choice)
3630ENDPROC
3640DEF FN_one_filename
3650REM decide what to do with filename
3660ptr% = 33 : old_ptr% = ptr%
3670un_decided = TRUE : matched = FALSE
3680extent = FN_extent
3690REPEAT
3700last_ptr% = old_ptr%
3710old_ptr% = ptr%
3720PTR #channel = ptr%
3730ptr% = BGET #channel + 256 * BGET #channel
3740REM follow chain of pointers
3750this_full$ = ""
3760FOR loop = 1 TO 31
3770this_full$ = this_full$ + CHR$(BGET #channel)
3780NEXT loop
3790this_small$ = MID$(this_full$,3,8)
3800this_mid$ = MID$(this_full$,1,10)
3810REM full, mid and small correspond to above
3820this_disc$ = MID$(this_full$,10,3)
3830un_decided = FN_decide
3840REM finished yet ???
3850UNTIL NOT(un_decided)
3860= un_decided
3870DEF FN_decide
3880IF ptr% = &FFFF THEN = 1 : REM append
3890IF this_full$ = full_name$ THEN = 2 : REM do noth
ing
3900IF this_mid$ = mid_name$ THEN = 3 : REM overwrite
3910IF small_name$ < this_small$ THEN = 4: REM insert
3920IF small_name$ = this_small$ AND ASC(full_name$)
< ASC(this_full$) THEN = 4 : REM nisert
3930IF ASC(full_name$) = ASC(this_full$) AND small_na
me$ = this_small$ AND disc_no$ < this_disc$ THEN = 4
3940= TRUE : REM continue testing
3950REM see text for explanation !!!!
3960DEF PROC_file_file(descision)
3970REM take action after descision
3980IF descision = 1 THEN PROC_append_file
3990IF descision = 3 THEN PROC_over_file
4000IF descision = 4 THEN PROC_insert_file
4010ENDPROC
4020DEF PROC_append_file
4030PTR #ch nnel = old_ptr%
4040BPUT #cnannel, extent MOD 256
4050BPUT #channel, extent DIV 256
4060REM set last pointer to current eof
4070PTR #channel = extent
4080BPUT #channel, &FF
4090BPUT #channel, &FF
4100REM and set pointer at current eof to null
4110PROC_filing_file
4120REM then add details at end
4130ENDPROC
4140DEF PROC_insert_file
4150PTR #channel = last_ptr%
4160BPUT #channel, extent MOD 256
4170BPUT #channel, extent DIV 256
4180REM set last pointer to current eof
4190PTR #channel = extent
4200BPUT #channel, old_ptr% MOD 256
4210BPUT #channel, old ptr% DIV 256
4220REM and pointer at current eof to existing link
4230PROC_filing_file
4240REM then add details at end
4250ENDPROC
4260DEF PROC_filing_file
4270REM add full details to current eof
4280FOR loop = 1 TO 31
4290BPUT #channel,ASC(MID$(full_name$,loop,1))
4300NEXT loop
4310PROC_added_1
4320REM increment record counter
4330ENDPROC
4340DEF PROC_printout
4350REM print out filed details
4360on  = 14
4370off = 0
4380REM emphasised printer commands
4390page = 1
4400REM page number
4410PROC_printin
4420REM get input from user
4430IF title$ = "none" THEN ENDPROC
4440VDU2,21
4450REM printer on screen off
4460channel = OPENUP("filecat")
4470PROC index
4480REM write index
4490PROC titles
4500REM write titles
4510VDU3,6
4520REM printer off screen on
4530CLOSE #0
4540ENDPROC
4550DEF PROC_printin
4560REM get users titles for printout
4570CLS
4580FOR loop = 0 TO 1
4590PRINTTAB(0,0+loop)CHR$(141)"Disc_cat printout"
4600PRINTTAB(0,3+loop)CHR$(141)"Title :
       :"
4610PRINTTAB(0,5+loop)CHR$(141)"Date  :
       :"
4620NEXT loop
4630REM format screen
4640title$ = FN_getin(8,4,20,FALSE)
4650date$  = FN_getin(8,6,20,FALSE)
4660REM get users input
4670ENDPROC
4680DEF PROC_index
4690REM printout index
4700line = FN_heading
4710REM start with page header
4720PTR #channel = 0
4730ptr% = BGET#channel + 256 *BGET#channel
4740REPEAT
4750PTR #channel = ptr%
4760ptr% = BGET#channel + 256 *BGET#channel
4770REM follow chain of pointers
4780num$ = CHR$(BGET#channel)+CHR$(BGET#channel)+CHR$
(BGET#channel)
4790disc$ = ""
4800REPEAT
4810chr = BGET#channel
4820IF chr <> &FF THEN disc$ = disc$ + CHR$(chr)
4830UNTIL chr = &FF
4840REM retrieve details
4850PRINTTAB(15);:VDU1,on:PRINTnum$;"      ";disc$: VD
U1,off
4860line = line+1
4870IF line = 55 AND ptr% <> &FFFF THEN PROC_footing
4880REM page full
4890UNTIL ptr% = &FFFF
4900PROC_footer
4910REM print footer ready for new page
4920ENDPROC
4930DEF FN_heading
4940REM header on page
4950PRINT''TAB(25);:VDU1,on:PRINT;"INDEX ";title$ : V
DU1,off
4960PRINT'''
4970= 6
4980DEF PROC_footing
4990REM print footer and header of next page
5000PROC_footer
5010line = FN_heading
5020ENDPROC
5030DEF PROC_footer
5040REM print footer only
5050REPEAT
5060PRINT
5070line = line+1
5080UNTIL line = 65
5090REM goto end of page
5100PRINTTAB(5);:VDU1,on:PRINT"page ";STR$(page);TAB(
25)date$:VDU1,off
5110page = page + 1
5120ENDPROC
5130DEF PROC_titles
5140REM printout filenames
5150line = FN_heading
5160REM start with header
5170PTR #channel = 33
5180ptr% = BGET #channel + 256 * BGET#channel
5190REPEAT
5200PTR #channel = ptr%
5210ptr% = BGET#channel + 256 * BGET#channel
5220REM follow chain of pointers
5230name$ = ""
5240FOR loop = 1  TO 10
5250name$ = name$ + CHR$(BGET#channel)
5260NEXT loop
5270num$ = CHR$(BGET#channel) + CHR$(BGET#channel) +
CHR$(BGET#channel)
5280num1$ = CHR$(BGET#channel) + CHR$(BGET#channel) +
CHR$(BGET#channel) + CHR$(BGET#channel)
5290num2$ = CHR$(BGET#channel) + CHR$(BGET#channel) +
CHR$(BGET#channel) + CHR$(BGET#channel)
5300num3$ = CHR$(BGET#channel) + CHR$(BGET#channel) +
CHR$(BGET#channel) + CHR$(BGET#channel)
5310REM recover information
5320PRINTTAB(20)name$;"  "num$;"   ";num1$;"  ";num2$
;"  ";num3$
5330REM and print it out
5340line = line+1
5350IF line = 55 AND ptr% <> &FFFF THEN PROC_footing
5360REM page full
5370UNTIL ptr% = &FFFF
5380PROC_footer
5390REM finish off
5400ENDPROC
```



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Megamon

Megamon is a sophisticated disassembler/monitor which will work on the complete range of Amstrad machines. Among its many features are an intelligent move memory facility, control over the lower Rom state, machine code trace, read or write object code to tape or disc, full memory dump to the printer, and a disassembly that will even understand all of the 102 undocumented Z-80 instructions. All of the controls are accessed through single key-presses so Megamon is easy to understand and simple to use.

Listing 1 is the short loader program for Megamon. Type this in and save it as the first thing on your tape as "MEGAMON". Listing 2 is the standard hex-loader program which pokes in the hex code from DATA statements. When all the bytes have been successfully entered then the loader program will prompt you to hit any key when ready to save the code. Ensure your tape is positioned after the megamon Basic loader.

To run the program rewind the tape and type RUN "MEGAMON"

When the program has loaded the little screen will appear and you will be asked for an address at which to load Megamon. this can be any address from 4000H up to 9000H. Obviously the monitor will not work if loaded underneath the lower Rom.

Once the address has been entered the object code for Megamon is loaded and you will be presented with Megamon's Front Panel screen display:

Laurie Sinnett's monitor takes you places you've no right to see in your Amstrad.

Z80 Registers — The top right of the screen shows the Z80 registers AF,BC,DE,HL,IX,IY together with the stack pointer (SP) and the program counter (PC). The register contents are shown (at start-up these are always zero) and then the contents of the memory location addressed by that register. there is also the register cursor (","), which points to AF on start-up. It's use will be discussed shortly.

Lower Rom State — Below the register display the state of the lower rom is shown, either Enabled or Disabled.

Memory Display — The memory display occupies the bottom of the screen and its purpose is to display the bytes around the memory pointer, indicated by ,. The bytes can be displayed either as hex or as ascii.

PC Instruction — The instruction at the Program Counter is contantly displayed above and to the left of the Memory Display.

List Display — The left of the screen above the Memory Display is taken up by the List Display. At start-up this display will be blank, but if you are eager to see it in action then for the moment press L followed by a full-stop. You will see the 14 instructions from address zero disassembled for your perusal.

Unfortunately, space does not permit a detailed discussion of the undocumented instructions, needless to say their use is becoming much more frequent in may of today's top games. Disassemblers that can cope with them are rare and the format for displaying them varies. For example, look at the instruction:

ADD A,IXL

This means "Add A to the low-byte of IX, the "L" tagged on to indicate the low-byte. Alternatively, you can use.

ADD A,IXH

This means 'Add A to the high bye of IXi.e. add A to I. Megamon would display the two instructions above as follows:

i) ADD A,iX

ii) ADD A,Ix

The letter in capitals indicates which byte of the register pair is being operated upon. The same applies to all undocumented instructions that use the IY register pair.

There now follows a list of the Megamon keys and a full explanation of their usage.

The Four Cursor Keys: The four cursor keys above the function pad are used to move the Memory Pointer ">" within the Memory Display in the appropriate direction, enabling you to step up or down through the memory, in steps of one or eight bytes at a time.

The Full Stop Key: Pressing the full stop will advance the Register Cursor >' onto the next register pair in the Register Display.

B — Return to Basic: Pressing this key will produce the prompt



"Are you Sure?", In response to this press "Y" if you wish to leave Megamon and return to Basic. Any other key press will return you back to Megamon itself. When Megamon returns to Basic it restores the Roms to whatever they were at start-up.

C — Clear List Window: The List Window can be cleared at any time by pressing the "C" key.

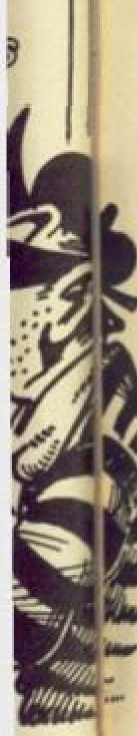
D — Display Memory: This allows you to change the address around which the Memory Display works. You will be asked for a new address for the Memory Prointer — this must be entered as a hex number teminated by a Return. If, instead of a hex number, you

Listing 1.

```
10 MODE 1
20 LOCATE 9,1:PRINT"LAJ Proudly present"
30 LOCATE 14,3:PRINT"MEGAMON"
40 LOCATE 9,5:PRINT"Copyright LAJ 1985"
50 LOCATE 1,7:INPUT "Load address";m:OPENOUT"d"
70 MEMORY m-1
80 CLOSEOUT:LOCATE 1,9:PRINT"Please wait..loading MEGA
MON V. 1.2":LOAD "!MEGAMON.bin",M
100 CALL m
```

Listing 2.

```
100 REM **** HEX LOADER *****
110 ADDR=32768:LIN=1000:MEMORY ADDR-1
120 SUM=0:READ A$,CHECKSUM
130 IF A$="END" THEN 200
140 FOR N=1 TO LEN (A$)-1 STEP 2:X=VAL ("&"+MID$(A$,N,
2))
150 POKE ADDR,X:SUM =SUM+X:ADDR =ADDR+1
160 NEXT
170 IF SUM<>CHECKSUM THEN PRINT "ERROR IN ";LIN  ELSE
LIN=LIN+10:GOTO 120
200 PRINT "DATA CORRECT";CHR$(13);"READY TAPE AND PRES
S A KEY"
210 SAVE "MEGAMON.BIN",B,32768,6127
220 END
 1000 DATA 3EC93200C0F3CD00C03B3BE1FB11F7FF19116614EB1
9E5DDE1DD6E00DD66017CB528182319E5FDE1FD6E00FD66, 5866
 1010 DATA 0119FD7500FD7401DD23DD2318DE3A920C8332920C3
2AB0CC60432B20C3EC3122153002201000ED73E30E31AA16, 4014
 1020 DATA CDE50ECD65BCCD00B9328E14CD1008CD210FCD03BBC
D440DCD770BCD6B0FCD070BCD1C0BCD18BBCD9B003E03CD, 4882
 1030 DATA B4BBCD6CBBCD11BC28CF3E01CD0EBCCD100818C521B
5000117000FE613802D620EDB1C00909095E2356D52A7E14, 4586
 1040 DATA C9424345D0D1D2D32E49525846 4D444C53544750484
14F57FF1360132D13F712AC12970F6910701 0FA00860DC8, 4362
 1050 DATA 0D190E460E4F0E740E7D0E8A0E8D0E950E900E9D0EA
B0EB40E3E0FCD630CC5DDE13007C8DD2A801418062004DD, 3665
 1060 DATA 2A7C14AF3288143E00CDB4BBCD6CBB060EDD228014C
D290110F7C9DDE5D1CD130C3A88143D202A3E09CD9702DD, 4729
 1070 DATA E5C5CD921241DD7E00DD23CD400C10F679FE0428053
E09CD97023E20CD9702C1DDE118053E08CD6FBB3E01328C, 4805
 1080 DATA 14C5AF329014DD7E00FEDD2005CD5304184 3FEFD200
A3E01329014CD53041835FECB2005CDD506182CFEED2005, 4557
 1090 DATA CDE3051823FE403809FE80300ACD17031816CD0E031
811FEC03005CDE7021808E607114303CD26033A8914B720, 3828
 1100 DATA 23CDC70278FE202811CDEA0179FE2028093E2CCD970
279CDEA013E0DCD97023E0ACD9702DD23C1C9FE513821FE, 5016
 1110 DATA 592009C5ED4B901481C11810FE6028F3FE5B3808C5E
```



press the full stop key then the Memory Pointer will be set to whatever address the Program Counter currently holds.

The address is displayed, along with its contents. You can either enter a new hex number for this location or press Esc to exit the memory change. When a new number is entered the memory pointer is advanced to the next location and your options are the same again. At any time during the input of a number you can press the Esc key to abort and leave the Memory Pointer unchanged.

E — Toggle Lower Rom State: Press the "E" key and the Lower Rom will be toggled between Enabled and Disabled.

F — Fill Memory: The prompt "Fill>" appears and the number entered here will be the start address for the program to use. You are then asked for the address at which the program will end its fill, and finally the byte to fill the memory with. For example, if you enter 8000 in reponse to "Fill >", 8100 in response to "To >", and FF in response to "With >", the memory between 8000 hex and 8100 hex will be filled with FF (255 decimal).

G — Go: This allows you to execute the object code currently under examination with the use of 'breakpoints, i.e., places at which the object code is stopped in its tracks and control returned to the monitor for you to examine the registers etc.

The address which you enter is response to 'Go>' will be the address at which the monitor starts execution of the object code. As usual with all prompts, if you press the Esc key then the operation will be aborted. You are then asked for an address — "To >" — at which control will be returned to Megamon i.e. the address at which you wish your breakpoint to be inserted.

When you have entered this address Megamon will go off and execute the code. When the breakpoint has been reached, assuming that the code has not caused a fatal crash, a small line will be displayed on the screen and this means that Megamon is wating for you to press any key before updating all of its displays.

H — Search For String: The prompt "Search For ">" is displayed. You can now enter a sequence of up to 255 bytes which will form the string which Megamon will search for. Each number should be entered by pressing Return and by pressing Return on its own you will terminate the string.

At this stage, assuming the sting can be found, Megamon will update the Memory Display and the Memory Pointer > will be pointing to the second byte of the input string. Also see the explanation of the next instruction, "A".

A — Find Next Occurence: Pressing the "A" key will tell Megamon to find the next occurence of a string you have searched for using H.

I — Toggle between Ascii and Hex: By pressing the "I" key you can toggle the Memory Display Memory so that it shows either Hex or the Ascii equivalents.

L — List: You can enter a new address from which the disassembler will list its 14 instructions. However, there are two other alternatives to entering a new address. If you press the full-stop key in response to List> then the disassembly will begin from the address currently held in the Program Counter.

Alternatively you can press Return in response to the prompt and the disassembly will continue from where it left off.

M — Move a Block of Memory: The prompt move > will be displayed and the address you enter will be the start of the memory block you wish to move, The prompt "End. ," asks you for the end address of the memory block and the prompt "To >" asks you for the destination address for this block. The routine is "intelligent" so that if your destination address lies within the limits of the block you wish to move Megamon takes this into account and performs the move correctly.

O — Read Object Code: This reads a block of object code from in from tape or disc, depending on which system is in use. You are prompted to enter a filename and then an address at which the code will be loaded. Needless to say, you should take care not to overwrite Megamon.

P — Printer Disassembly: With this option you can produce a disassembly of any length to your printer, you could even list the Amstrad Rom. Then first address you enter, in response to "Print ,", is the start address for the disassembly, and the second address is the end. Assuming the printer is connected a disassembly will now appear on the printer which can be aborted at any time by pressing the Esc key.

R — Change Register: By pressing the "R" key you can change the value of the register pair currently pointed to by the register cursor $>_1$. The register pair will take on the value you enter at the keyboard.

S — Single Step: Megamon will execute the current instruction at the Program Counter when you press the "S" key, allowing you to examine the effects of the code upon the registers and memory. This function will aslo single-step through a Call isntruction.

T — Trace: If you press the "T" key Megamon will execute the instruction at the Program Counter in the same way as the "S" function above, except that using "T" allows you to execute a Call instruction automatically.

W — Write Object Code: This writes a block of code to tape or disc under a given filename. You are prompted to enter the filename and then the first and last (inclusive) addresses of the block you wish to write.

X — Toggle Alternative Registers: Pressing the "X" key will toggle the Register Display between AF,BC,DE, HL and the alternate registers AF',BC',DE',HE'. You are advised to leave the values in the alternate register set unchanged as these are in constant use by the firmware (for further details see the *Amstrad Firmware Specification* — Soft 158, Appendix XI).

If the sight of all those hex bytes is enough to put you off then copies of Megamon, recorded on quality blank tapes, are available a cost of £3.50 each, including postage, from Laurie Sinnett, 20 Autumn Street, Burley, Leeds LS3.

```
D4B9Ø148181C1CD41ØFC9FE183ØØ6C61ECD41ØFC92Ø193A, 4978
 112Ø DATA 8C14A72ØØ77BC63ØCD97Ø2C9ØE2Ø3E23CD97Ø27BCD4
ØØCC9FE192ØØBØE2Ø3E23CD97Ø2CD13ØCC9FE1A2Ø133E28, 4Ø93
 113Ø DATA CD97Ø23E23CD97Ø2CD13ØC3E29CD97Ø2C9FE1B2Ø143
E28CD97Ø23E23CD97Ø27BCD4ØØC3E29CD97Ø2C9FE1C2Ø2Ø, 4371
 114Ø DATA 3E28CD97Ø23A9Ø14C659CD41ØF3E2BCD97Ø23E23CD9
7Ø27CCD4ØØC3E29CD97Ø2C9F53A88143D28Ø6F1CD5ABBA7, 4695
 115Ø DATA C9F1D55FC5CD2BBDF5E53E42CD1EBB2ØØ9E1F1C17B3
ØECD1A7C9AF32881431AA16C36ØØØE57DCD41ØF3A8814B7, 6Ø41
 116Ø DATA 2ØØ43EØF18ØC3D2ØØ73EØ9CD97Ø2E1C93EØ6CD6FBBE
1C9ØFØFØFE6Ø7C6396FDD7EØØCDF6Ø7DD7EØØFE9Ø3ØØ4Ø6, 4357
 117Ø DATA Ø718ØDFEAØ3ØØ6FE9838Ø218F241ØE2ØC9E6Ø71133Ø
3CD26Ø3C9FE762E1ØØ12Ø2Ø28Ø52E11CDF6Ø7C9876F26ØØ, 3859
 118Ø DATA 197E23666FDD7EØØE9Ø8Ø7CBØ76EØ7BEØ7A5Ø7ADØ7B
1Ø7EAØ7Ø5Ø4D4Ø3ØFØ482Ø322Ø463Ø326Ø444Ø4ØDØ61BØ6, 2977
 119Ø DATA 2AØ639Ø653Ø65EØ67ØØ691Ø6CB5F2ØØC2E58CDØ2ØØ7
8FEØBCØØ651C92E4EØ619DD5EØ1DD56Ø2DD23DD23C9FEC3, 4Ø67
 12ØØ DATA 2ØØF2E4DØ619DD5EØ1DD56Ø2DD23DD23C9FED32ØØ82
E53Ø61BØEØ718ØAFEDB2ØØC2E54Ø6Ø7ØE1BDD5EØ1DD23C9, 3735
 121Ø DATA FEE32ØØ72E55Ø6ØFØEØAC9FEEB2ØØ72E55Ø6Ø9ØEØAC
9Ø12Ø2ØFEF32ØØ32E56C92E57C9CB5F2ØØC2E5ØCDØ2Ø878, 3863
 122Ø DATA FEØBCØØ651C9FEC9Ø12Ø2Ø2ØØ32E4CC9FED92ØØ32E5
2C9FEE92ØØ52E4DØ6ØEC92E11Ø6ØBØEØAC92E4CCD63Ø778, 41Ø4
 123Ø DATA C61Ø47C92E4DCD63Ø7ØE19DD5EØ1DD56Ø2DD23DD231
8E82E4E18EBØFØFØFE6Ø7C6396FØ6Ø7ØE18DD5EØ1DD23FE, 426Ø
 124Ø DATA 3B2ØØ441ØE2ØC9FE3DD818F7E6382E4F5FØ618ØE2Ø3
EØ1328C14C9DD7EØ1FECB2Ø2ØDD7EØ3E6Ø7FEØ6DD23C29F, 459Ø
 125Ø DATA Ø5DD23CDD5Ø63EØ6B92ØØ4ØE1C18Ø2Ø61CDD66FFC9F
E4ØD242Ø5DD23E6Ø7CA9FØ5FEØ7CA9FØ5FEØ12Ø1ADD7EØØ, 46ØØ
 126Ø DATA CDCBØ73EØAB928ØAB82ØØ9DD2BDD2BC39FØ5ØE59Ø65
9C9FEØ22Ø23DD7EØØFE222Ø11Ø61AØE592E11DD5EØ1DD56, 4Ø69
 127Ø DATA Ø2DD23DD23C9FE2AC29FØ5ØE1AØ65918E8FEØ32Ø17D
D7EØØFE232ØØ72E12Ø659ØE2ØC9FE2BC29FØ52E1318F2FE, 4393
 128Ø DATA Ø42Ø1EDD7EØØCDA5Ø778FEØ4DA9FØ5FEØ7CA9FØ5CDA
AØ578FE1CCØDD66Ø1DD23C9FEØ52ØØ8DD7EØØCDADØ718DC, 52Ø7
 129Ø DATA DD7EØØFE262ØØCØ65B2E11ØE18DD5EØ1DD23C9FE2E2
ØØ4Ø65C18EEFE36C29FØ5Ø61CDD23DD66ØØ18EØFE8Ø3Ø14, 4327
 13ØØ DATA DD7EØ1FE76DD23CA9FØ5CD17Ø3CDAAØ5DD66ØØC9FEC
Ø3ØØCDD23CDE7Ø2CDAAØ5DD66ØØC9DD23FEE12ØØ72E5ØØ6, 5487
 131Ø DATA 59ØE2ØC9FEE52ØØ42E5818F3FEE92ØØ62E4DØ66Ø18E
BFEE32ØØ72E55Ø6ØFØE59C9FEF92ØØ72E11Ø6ØBØE59C92E, 4213
 132Ø DATA 5FØ12Ø18DD2BDD5EØØC926ØØ79FEØ62ØØ5DD23ØE1CC
978FEØ62ØØ5Ø61CDD23C978FEØ438Ø9FEØ63ØØ5C6574726, 3945
 133Ø DATA Ø179FEØ438Ø9FEØ63ØØ5C6574F26Ø17CA7CØE1C39FØ
5DD23DD7EØØFE8Ø381321D4Ø6Ø11ØØØEDB9C29FØ579C662, 4753
 134Ø DATA 6FØ12Ø2ØC9FE4ØDA9FØ5E6Ø71153Ø3CD26Ø3C92E54C
DF6Ø7ØE7278FEØ6CØØ673C92E53CDF6Ø748Ø67279FEØ6CA, 4836
 135Ø DATA 9FØ5C92E3CCB5F28Ø22E3ACDØ2Ø848Ø6ØAC92E11CDØ
2Ø8ØE1ADD5EØ1DD56Ø2DDCBØØ5EDD23DD23CØ7814FC92E, 4Ø95
 136Ø DATA 74Ø12Ø2ØFE44C8C39FØ5Ø12Ø2ØFE452ØØ32E75C92E7
6FE4DC8C39FØ5AF328C14DD7EØØ2E77Ø12Ø181EØØFE46C8, 4411
 137Ø DATA 1CFE56C81CFE5EC83EØ1328C14C39FØ52E11ØEØ7FE4
72ØØ3Ø678C9FE4F2ØØ3Ø679C9Ø6Ø7FE572ØØ3ØE78C9FE5F, 4316
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(continued on next page)

Megamon

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```
 1380 DATA 20030E79C9012020FE6720032E7AC9FE6FC29F052E7
BC9A0A1A2A3A8A9AAABB0B1B2B3B8B9BABBAF328C14DD7E, 5798
 1390 DATA 01FE40301300F0FE607C6416FDD7E01CDF607410E2
018122E49FE8038062CFEC038012CCDF607580618DD23C9, 4188
 1400 DATA FE203819CD6307CB9078C61047DDE5E1DD7E01CD530
70E192E36DD23C9A720062E1D012020C9FE082002E3701, 4292
 1410 DATA 2020C9FE10200A2E38DD7E01CD5307180082E36DD7E0
1CD5307061 9DD23C9C5E5C6024F179F47DDE5E109EBE1C1, 4880
 1420 DATA C9F50F0F0FE60747F10E20C9FE202E113014CD02087
8C604DDCB005E200447 0E07C94F0607C90607FE30300206, 3752
 1430 DATA 0A0E1ADD5E01DD5602DDCB005EDD23DD23C078414FC
92E12CDF6070E20C92E1318F62E11CDF6070E18DD5E01DD, 4562
 1440 DATA 23C92E12CB5F28012CCD02080E20C92E11CB5F28092
E14CD02084 8060AC9CD02080E19DD5E01DD5602DD23DD23, 3516
 1450 DATA C90F0F0FE607C6156F012020C9F5E6074FF10F0F0FE
60747C9F50F0F0F0FE603C608470E20F1C9DD214F080607, 4092
 1460 DATA C5DD7E00CDB4BBDD6601DD6E02DD5603DD5E04CD66B
BDD7E05CD90BBDD7E06CD96BBDD7E07A72005CD7EBB1803, 5782
 1470 DATA CD7BBB110800DD19C110C8C90000001C0D010000010
00F1C0F0100000205112116010000030018271801000104, 1674
 1480 DATA 1D0227090100000051D0B270D010000061D002709010
000204C4F57455220524F4D0D0A0A00202045 4E41424C45, 1477
 1490 DATA 4400204449534142 4C4544004146200D0A4243200D0
A4445200D0A484C2000041462 70D0A424327 0D0A4445270D, 1999
 1500 DATA 0A484C2700495800D0A49590D0A53500D0A504300417
265207 96F75207375726 5203F002020202020000 52656769, 2685
 1510 DATA 737465720046696C6C00546F005769746800 4D6F766
5000456E6400446973706C6179004C697374000484 14C5400, 3565
 1520 DATA 4C4400494E43004445430041444400524C434100525
2434100524C41005252410044 41410043504C0053434600, 2446
 1530 DATA 434346004E4F500004200430044004500480004C00284
84C2900410042430004445000484C00535000284243290028, 1988
 1540 DATA 44452900284 84C29002853502900 4E5A005A004E430
04300504F0050450050004D004A520045582020202020 41, 2124
 1550 DATA 462C41462700444A4E5A00414444004144430053554
2005342430004 14E4400584F52004F520043500005 24C4300, 2442
 1560 DATA 52524300524C00525200534C4100535241005 34C4C0
053524C0004249540005245530053455400524 554004A5000, 2565
 1570 DATA 43414C4C00525354005 04F50000414600455858004F5
554004 94E004558000444900454900505553480004958 0049, 2545
 1580 DATA 590004978000695800049790006959000444546420028495
82900028495929004C44490004350490004 94E49004F555449, 2603
 1590 DATA 004C4444000435044 00494E44004F555444004C44495
2004350495200494E4952004F5444952004C444452004350, 2628
 1600 DATA 4452004 94E4452004F54444520028432900046004E454
70052455 44E005245544900494D00049005200525244 0052, 2440
 1610 DATA 4C4400476F00546F005072696E7400536561 7263682
0666F72005468656E00203E004C6F616400537461727400, 3406
 1620 DATA 536176652066726F6D00457865637574696F6E20616
46472657373004E616D65003E01CDB4BBCD6CBB3E023288, 4359
 1630 DATA 14DD2A7C14CD6401C9F5C5D5E53E02CDB4BB210101C
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 1640 DATA 02CD4E0B10F3CD610BE1D1C1F1C9F5C506083E20CD9
7021A13CD1E0C10F4C1F1C93A7E14E6074F8781C606672E, 5169
 1650 DATA 03CD75BB3E3ECD9702C9F5C5D5E53E013286143E04C
DB4BB210101CD75BB3A8514C603CD410F210501CD75BB3E, 4835
 1660 DATA 05CD410F216E143A8514A72803216614CDE70B3E053
28614217614CDE70BCDC00BE1D1C1F1C93A84143C6F2604, 4265
 1670 DATA CD75BB3E3ECD9702C93E04CDB4BB3A8414E6073C6F2
604CD75BB3E20CD9702C90604EB3A86146F2605CD75BBEB, 5007
 1680 DATA 5E235623D5CD130CEB3A86146F3C328614260ACD75B
BEBD11ACD1E0C10D7C9F57ACD400C7BCD400CF1C9F53A87, 5159
 1690 DATA 14A7281AF1F5C50E2EFE203805FE7E30014F79CD970
23E20CD9702C1F1C9F1F5E6F00F0F0FFE0A3802C607C6, 5158
 1700 DATA 30CD9702F1F5E60FFE0A3802C607C630CD9702F1C9F
53E03CDB4BBF1CD410F3E81CD410FCD78BB22821421 2020, 5387
 1710 DATA 22ED0822EF0811ED08CD18BBCD1A0D20F8FE5F200B7
BFEED282F1B3E20121829FE0D2832FEFC3728664FFE2E20, 4530
 1720 DATA 077BFEED20D618677BFEF179200C21EE0811ED08EDA
0EDA0EDA012132A8214CD75BB3E07CD410F18B33AED08FE, 5361
 1730 DATA 20282E01000021ED087EFE20282FD630FE0A3802D60
7171717171 7CB11CB1017CB11CB1017CB11CB1017CB11CB, 3625
 1740 DATA 102318D83EFFA737F5C5CD6CBBC1F1C93EFFA718F3A
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 1750 DATA E1C9303132333435363738394142434445462E5F0D3
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 1760 DATA 0608218 00D56CB113802162078FE062811FE04280D7
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 1770 DATA 630CC83004ED4B7E14ED437E14CD1C0B3E03CDB4BBC
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 1780 DATA CD720C2A7E143003C838017123227E1418CE3E0CCD6
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 1790 DATA D8C8AFE5ED5230079FE1EBA7E5ED52E3CD0A0E380A5
059C1EB09EB03EDB8C9EB5059C103EDB0C9E5A7ED42E1D8, 6870
 1800 DATA EBE5A7ED42E1EB3FC93E09CD630CD8C8C53E0ACD630
C381C281AC53E0BCD630C381128 0F79E1D112A7ED52444D, 5114
 1810 DATA 626B13EDB0C9C1C1C93A8514EE01328514C93E08CD6
30CD8216E143A8414FE04 30093A8514A72803216614 3A84, 4335
 1820 DATA 14875F1600197123 70C93A8714EE01328714C9CDD00
B3A84143CE60732841 4C923180C2B180911F8FF18031108, 3669
 1830 DATA 0019227E14C93A8D14EE01328D14CA09B9C306B93E0
0CDB4BBCD6CBBC93E03CDB4BB3E06CD410FCD81BBCD18BB, 5119
 1840 DATA FE79280BFE592807CD84BBCD6CBBC93E01CD0EBC3A8
E14CD0CB9ED7BE30EC90000CD210F3E01CD0EBCAF328D14, 5044
 1850 DATA CD09B9328E14216E14116F14014901 3600EDB0F308F
5E12266140 8D9ED436814ED536A14226C14D9FB2AE30E22, 4387
 1860 DATA 7A14C9AF0604213D0FF5C5E54648CD32BCE1C1F13C2
310F106004 8CD38BCC9001200 00F5C5D5E52187 08B7280A, 4943
 1870 DATA 57AF01FFFFEDB11520F87EB7280CCD97022318F6E1D
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 1880 DATA CD75BBAFCD410FCD06B9F5CD0CB9F1CB573E01CA410
FAF328D143E02C3410FED738C123E7CCD630C3007C8ED4B, 5192
 1890 DATA 7C1418062004ED4B7C14C53E7DCD630C3009C1C8C5E
D4B7C1418062004ED4B7C146960E51166100103 00EDB0E1, 4198
 1900 DATA 36CD0111102371237 0F3D9ED436410ED536210226 01
0D908F5E1225E1008C1ED7B7A14C5ED737A14316614F1C1, 4886
 1910 DATA D1E1D908F1C1D1E1DDE1FDE1ED7B7A14FBC9E32B2B2
B227C14C5D511661 0EB010300EDB0D1C1E1F3ED737A1431, 6549
 1920 DATA 7A14FDE5DDE5E5D5C5F5D9E5D5C5D908F508ED7B8C1
22A5E10E5F1082A6010ED5B6210ED4B6410D9FB3E5FCD97, 6445
 1930 DATA 02CD18BBC90000000000000000000003E01328F141
804AF328F14F3D9C5D5E5D908F508CD8A1000F108D9E1D1, 4155
 1940 DATA C1D9FBC9CD8E12ED5B7C14ED738C12213D11E506043
6002310FBEBD10600EDB0227C14DD213D11DD7E00FE76CA, 5209
 1950 DATA 5911215F120109 00EDB1CA5E1101090 0EDB1CAAA110
10900EDB1CA851101060 0EDB1CAD411010800EDB1CA2D12, 4118
 1960 DATA FEE9CAC111FEDD200BDD7E01FEE9CAC611DD7E00FEF
D200BDD7E01FEE9CACB11DD7E00FEED2021DD7E01FE4520, 6429
 1970 DATA 0BDD3600C9DD360100C38511FE4D200BDD3600C9DD3
60100C38511316614F1C1D1E1D908F1C1D1E1DDE1FDE1ED, 5872
 1980 DATA 7B7A1400000000F3ED737A14317A14FDE5DDE5E5D5C
5F5D9E5D5C5D908F508ED7B8C12C93A8F14A7C22811CD49, 5979
 1990 DATA 12228A12217411CD5012C32811E12A7C14E52A8A122
27C14ED737A1418D4DD7E00FEC92810F6C2E6FA219C11DD, 4880
 2000 DATA 7700CD5012C32811ED7B7A14E1227C14ED737A1418A
FCD4912228 81221B911CD5012C328112A8812227C141898, 4096
 2010 DATA 2A741418082A761418032A7814227C14C35911DD7E0
14F179F472A7C1409228812DD7E002A6E14E5FE10282CFE, 3497
 2020 DATA 382810FE302812FE202814FE282816E1C3B911F138F
AC35911F130F4C35911F120EEC35911F128E8C35911ED4B, 5416
 2030 DATA 7014F105F5E1226E14ED43701420D4C359112A7C14E
D7B7A14E5ED737A142156124104231 0FD4EED437C14C359, 4724
 2040 DATA 11DD6602DD6E01C9DD7402DD7501C938302820181 00
800DCFCD4CDC4F4ECE4CCDAFAD2C3F2C2EAE2CAC9D8F8D0, 6819
 2050 DATA C0F0E8E0C838302028180C7CFD7DFE7EFF7FF000000
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 2060 DATA ED424DDDE1AF328914C93E7ECD630CC5DDE13007C8D
D2A8014180620 04DD2A7C143E7DCD630CD8C8DDE5E1ED42, 5592
 2070 DATA 2801D0ED43F5123E01328814CD2901DDE5E1ED4BF51
2ED4228F238F03E0CCD2BBDAF328814C90000 3E7FCD630C, 5061
 2080 DATA D8C8DD219214DD36000079328B143E01328A143E80C
D630C3003C8181428F4DD23DD71003A8A143C328A1420E6, 4133
 2090 DATA 3D328A143A8A14B7C82A7E1401FFFF3A8B14EDB1C0C
5E5DD2193143A8A143D280C47DD7E00BE200BDD232310F5, 4769
 2100 DATA E1C1227E14C9E1C118D83E82CD9F13D8C53E83CD630
CD138222820C5215214421100A9CD77BCF5D47DBCF1E130, 5705
 2110 DATA 11CD83BCF5D47DBCF13007CD7ABCCD6CBBC92100002
B7CB520FB18F2F53E03CDB4BBCD6CBBF1CD410F3E81CD41, 6122
 2120 DATA 0F21521416 00CD18BBFEFC2836FE0D2837FE2038F1F
E8030EDFE7F201714152BE52B153E08CD5ABB3E20CD5ABB, 4738
 2130 DATA 3E08CD5ABB18D24F7AFE1428CC7179CD5ABB231418C
3CD6CBB37C9D5CD6CBBC1A7C93E84CD630CD8C8C53E7DCD, 6040
 2140 DATA 630C383828 36C53E85CD630C382D282BC53E86CD9F1
33822215214110 0A9CD8CBC301B3E02C1E1D1D5A7ED52EB, 4629
 2150 DATA E1CD98BC300ECD8FBCCD6CBBC9E1E1E1C9E1E1E1CD9
2BCCD6CBBC9000000000000000000000000000000000000, 4860
 2160 DATA 0000540057005A006600630069006F007200750078 0
07B00810096009B00B100CF00D100D300D500D700D900DB, 3254
 2170 DATA 00DD00DF00E100E300E500E700E900EB00ED00EF00F
100F300F500F700FC0006010E011201200123012C012F01, 3731
 2180 DATA 37013D01460152015701660 16B0175018001830 18C0
19501A201A701B001B701BA01BD01C301CB01D501D901DE, 3364
 2190 DATA 01E301F401050 20B0215021B0224022C0230023C023
F0249024E0251025602600265 0269026E0278027B028002, 1930
 2200 DATA 85028A028E029302980 2BE02C102C402C902CC02DB0
26903F20210031303220332033403360338033A033C033E, 2777
 2210 DATA 034003420344034603480 34A034C034E0350035203 5
403560358035A035C035E036003DA030704110463046804, 1878
 2220 DATA 7C049204A104C704E404F204F804FD04000514053 60
54D0550055305600563 05EC05F405010606060 9060F061D, 2756
 2230 DATA 06260632063B065B066D06710 68E06BF06D606EB06F
F060C071B0741074B077407A707B307C507D307DA071108, 2931
 2240 DATA 150B180B2B0B390B3E0B410B460B540B590B610B730
B7D0B8B0B900B9B0B9E0BA10BA70BAA0BAF0BB20BB50BB8, 2906
 2250 DATA 0BC00BCC0BD50BE30BEA0BF90BFD0B020C0D0C150C1
90C1F0C340C390C4F0C5E0C6A0C6F0C750C7B0C7E0C810C, 2926
 2260 DATA 870CB60CB90CC40CCC0CD10CDB0C260D4F0D530D580
D5E0D720D7A0D880D8F0D930D960DA20DA50DAA0DAE0DB3, 3653
 2270 DATA 0DB60DB90DC30DCA0DD20DD50DDE0DF30D1B0E230E2
D0E460E4B0E510E550E580E5F0E650E680E740E790E7D0E, 3133
 2280 DATA 800E860E990E9D0EA20EBB0ED80EDF0EE50EEE0EF40
EF70EFA0E080F0E0F120F150F1A0F1D0F240F450F590F6D, 3304
 2290 DATA 0F7C0F8B0F8F0F940F980F9D0FA40FAC0FB20FBB0FC
30FC90FD40FDE0FE20FE50FEC0FF20FF70FFA0F0C101510, 4204
 2300 DATA 1A1028102B103F10421048104C10501057106B10711
07D108A108E10921095 10A610AA10B210B510BD10C510CD, 3111
 2310 DATA 10D510DD10E210EE10FD1016112511281 13A1143114
6115A115E11621165116811 6B116E1171117511 79117C11, 3009
 2320 DATA 8011901196119911 9D11A111A511AA11AD11B011B31
1B611B911BC11C111C611CB11CE11D111DB11DF11E511FE, 4619
 2330 DATA 1104120A12101216121A12211225122A122D1231123
61239124312461 28F1296129912A812AE12B812C012C512, 2306
 2340 DATA D312D812DB12E212F112F912FF12071 30C131113201
324132A132D13321338134113441358134D0050004F0411, 2746
 2350 DATA 0B8304880 43B003F0042004700D800DE0058B06CB00C
D00621369137213B113A913AE13011409141314 1D142?14, 2699
 2360 DATA 0000300200303001003 00E00303030303030303030303
030303030020030300100300C0030303030303030303030, 1520
 2370  DATA  END.0
```



ATARI ST

520ST

POWER WITHOUT THE PRICE

THE NEW ATARI 520ST

Under the new leadership of Jack Tramiel (former boss and founder of Commodore Business Machines), Atari Corporation have marked their entry into the world of business/personal computers with a machine which leaves the competition standing. Tramiel's slogan 'Power Without the Price' has been implemented in the manufacture of the new 512K Atari 520ST colour computer which offers the user amazingly high performance at an incredibly low price. Launched as a work-station, this new system incorporates seven software packages as well as the 520ST computer with 512K RAM, mouse controller, high resolution monochrome monitor (640x400), 95 key keyboard (with 18 key numeric keypad), MIDI interface, GEM and a 500K 3½ inch disk drive, all for the package price of only £651.30 (+VAT = £749). Dubbed the 'Mac beater' and the 'Jackintosh' (after Atari's Chief, Jack Tramiel), Atari's new machine has been directly compared with the Apple Macintosh RRP £2595 (+VAT = £2985) which offers similar features and capabilities but at a much higher price. Favourably reviewed by the UK's highly critical specialist computer press, the 520ST is likely to make a great impact in this country as a sophisticated alternative to an IBM PC, APRICOT or APPLE MACINTOSH. Unlike its overpriced competitors, the Atari 520ST can be linked up to a colour monitor to unleash a choice of up to 512 colours. The addition of colour brings out the full potential of graphics packages such as GEM.

USER FRIENDLY GEM OPERATING SYSTEM

The power of the ST is harnessed and made user friendly by the new operating system 'GEM' from Digital Research. GEM stands for Graphics Environment Manager and allows a user friendly colour or B/W graphics interface which closely resembles that of the Macintosh. This similarity extends to the use of moveable resizeable windows, icons to represent objects such as disks and disk drives, and the use of pull down menus and a mouse. The advantage of all this is that the computer becomes extremely easy to use. GEM has now been implemented for the Acorn, ACT, Atari, IBM, ICL, and Olivetti. Software written for GEM on one computer should also run under GEM on another computer. This will enable the market to quickly produce a large library of standard interchangeable software.

FREE SOFTWARE AND FUTURE EXPANSION

The Atari 520ST comes supplied with seven free software packages as listed below. 1) TOS - Tramiel Operating System based on CPM 68K. 2) GEM Graphics Environment Manager by Digital Research (DR) giving a WIMP (Window, Icon, Mouse, Pull down menu) environment. 3) DR GEM Paint for creating graphics masterpieces. 4) DR GEM Write for word processing. 5) Logo learning language to enable you to write your own programs easily using turtle graphics. 6) DR Personal Basic a powerful user friendly version of the Basic programming language. 7) BOS operating system giving you access to dozens of business applications packages already available on the market. Designed with future expansion in mind, the ST also features a host of different interfaces to the outside world and an impressive list of accessories is planned. Atari will soon be releasing a 1000K (1MB) 3½ inch disk drive, and a 15MB hard disk storage system as well as a mass storage compact disk (CD) player capable of storing an entire 20 volume encyclopedia on one disk. A full range of inexpensive printers are planned including dot matrix, daisywheel and thermal colour printers. With its unbeatable graphics, speed and software at a price which is far below that of any comparable personal computer currently on the market, the ST is all set to do battle with the competition. To receive further details of the ST from Silica Shop, just fill in the coupon below with your name and address details and post it to us.

Silica Shop Price: £651.30 + £97.70 VAT = £749.00 This price includes:

- ★ 512K RAM
- ★ MOUSE
- ★ GEM
- ★ B/W MONITOR
- ★ 500K 3.5" DISK DRIVE
- ★ KEYBOARD (95 KEYS)

£749

ATARI 520ST SPECIFICATION

MEMORY
512K RAM (524,288 bytes)
16K ROM expandable to 320K
Port for addnl 128K plug-in ROM cartridges
200K TOS operating system

GRAPHICS
Individually addressable 32K bit-mapped screen with 3 screen graphics modes:
320x200 pixels in 16 colours (low resolution)
640x200 pixels in 4 colours (med resolution)
640x400 pixels in monochrome (high res)
16 shades of grey in low res mode
512 colours available in low/medium res
8 levels of each in red, green and blue

ARCHITECTURE
4 custom designed chips:
GLUE Chip - MMU Memory Mngmnt Unit
DMA Controller - Graphics Processing Unit
16/32 bit Motorola 68000 processor at 8MHz
eight 32 bit data registers
eight 32 bit address registers
16 bit data bus/24 bit address bus
7 levels of interrupts/56 instructions
14 addressing modes/5 data types

DATA STORAGE
High speed hard disk interface
Direct memory access 1.33 Mbytes per second
CD (Compact Disc) interface
Built in cartridge access
Dedicated floppy disk controller

DISK DRIVE
500K (unformatted) s/sided 3½" floppy d/drive
349K (formatted) storage capacity

SOUND AND MUSIC
Sound Generator
Frequency control from 30Hz to above audible
3 voices (channels) in wave shaping sound in addition to a noise generator
Separate frequency and volume controls
Dynamic envelope controls
ADSR (Attack, Decay, Sustain, Release)
Noise generator
MIDI interface for external music synthesizers

KEYBOARD
Separate keyboard microprocessor
Standard QWERTY typewriter styling
Ergonomic angle and height
95 keys including 10 function keys
Numeric keypad — 18 keys including ENTER
One touch cursor control keypad

MONITOR
12" screen - high res monochrome monitor
640x400 monochrome resolution

VIDEO PORTS
Display - Low Resolution - 40 columns
Med/High Res - 40/80 plus cols
Medium res RGB (Red/Green/Blue) output
High resolution monochrome (Black & White)

COMMUNICATIONS
Bidirectional centronics parallel interface for printers, or modems capable of input/output
RS232C serial modem/printer interface
VT52 Terminal Emulation Software
Maximum Baud Rate up to 19,200
High speed hard disk interface
Floppy disk controller (Western Digital)
2 joystick ports (one for 2 button mouse)
MIDI interface for external music synthesizers

GEM WIMP ENVIRONMENT
WIMP - Window Icon Mouse Pop-down menus
Two button mouse controller
Icons/Pull down menus/Windows
GEM VDI - Virtual Device Interface
GEM AES - Application Environment Services
GEM BBT - Bit Block Transfer
Real time clock & calendar

SOFTWARE
GEM environment
with user friendly Macintosh style operation
'TOS' - Tramiel Operating System
Atari's own system based on CP/M 68K with hierarchical directory & file structure plus a host of MS DOS & UNIX command structures
'BOS' - Business Operating System
to run any standard BOS business programs
GEM desktop
with GEM PAINT graphics mgmt system and GEM WRITE word processor
Personal BASIC and DR Logo
originally written by Digital Research (DR) very much like those on other machines except for the extensive use of pull down menus, mouse control and windows

VARIOUS
Dimensions: 470mmx240mmx60mm
Replaceable external power supplies
Expansion: 3½" floppy disk drives 500K/1,000K (two drives can be connected)
3½" 15MB hard disk
CD (compact laser disc)
Dot matrix & d/wheel prntrs (black)
Thermal dot matrix (colour)
RGB & monochrome monitors

LANGUAGES
BASIC & LOGO supplied
Many others will soon be available, including: Assembler, BCPL, C, Cobol, Compiled Basic, Lisp, Modula-2 and Pascal

Note: Some of the above specifications are pre-release and may therefore be subject to change

MACINTOSH v F1e v 520ST

"Imagine a Fat Mac - the 512K Apple Macintosh - but with a bigger screen, a far bigger keyboard with numeric keypad, cursor and function keys, and colour. That gives you some idea of what the Atari 520ST is like, except for two important things. First the Atari seems faster. Second the Atari system is about one third of the price."
June 1985 - Jack Schofield - **PRACTICAL COMPUTING**

FEATURES OF BASIC SYSTEM	APPLE MACINTOSH	APRICOT F1e	ATARI 520ST
Price includes B/W Monitor	YES	NO - extra £200	YES
Keyboard size mm (LxDxH)	330x147x50	450x167x28	470x240x60
Keyboard size ins (LxDxH)	13x5¾x2	17¾x6½x1	18½x9½x2⅜
3½" D/Drive (Unformatted)	500K	500K	500K
3½" D/Drive (Formatted)	390K	315K	349K
WIMP (Window, Icon, Mouse ...)	Apple	ACT - Activity	GEM
Real-time Clock	YES	YES	YES
Polyphonic Sound Generator	YES	NO	YES
RS232 Serial Port	YES	YES	YES
Centronics Parallel Printer Port	NO	YES	YES
Dedicated Floppy Disk Controller	NO	YES	YES
Hard Disk DMA Interface	NO	YES	YES
Full stroke keyboard	YES	YES	YES
Number of keys on keyboard	59	92	95
Numeric Keypad	NO	YES (16 Keys)	YES (18 keys)
Cursor Control Keypad	NO	YES	YES
Function keys	NO	10	10
16-bit processor	68000	Intel 8086	68000
Processor running speed	8MHz	4.77MHz	8MHz
RAM size	512K	256K	512K
Number of graphics modes	1	4	3
Number of colours	Monochrome	16	512
Max Screen Resolution (pixels)	512 x 342	640 x 256	640 x 400
Mouse included	Single Button	NO - extra £95	Two Button
Replaceable External Power Pack	NO	NO	YES
Cartridge Socket	NO	NO	YES
Joystick Ports	NO	NO	YES (two)
MIDI Synthesiser Interface	NO	NO	YES
Monitor Size	9"	9" - extra £200	12"
RGB Video Output	NO	YES	YES

System Cost with: Mouse - Monochrome Monitor - 512K RAM - 500K Disk Drive

Price of basic system (exc VAT)	£2595+VAT	£595+VAT	£652+VAT
+ Mouse	Included	£95+VAT	Included
+ Monochrome Monitor	Included	£200+VAT	Included
+ Expansion to 512K RAM	Included	£295+VAT	Included
Price of complete system (exc VAT)	£2595+VAT	£1185+VAT	£652+VAT
PRICE rounded down including VAT	**£2,984**	**£1,362**	**£749**

PRESS COMMENT

"Atari's new corporate image as an aggressive low cost computer maker is likely to mirror that of Commodore where Mr. Tramiel established the maxim that 'Business is war'."
August 21st 1984 **FINANCIAL TIMES**

"This is the only personal computer I know of that comes with a Midi interface as standard."
Peter Bright March 1985 **PERSONAL COMPUTER WORLD**

"The (GEM) version running on the Atari 68000 machines will have the additional advantage of leaving the PC version standing." April 8th 1985 **PERSONAL COMPUTER NEWS**

"It would seem that GEM offers the ideal operating system."
March 7th 1985 **POPULAR COMPUTING WEEKLY**

"I found it (GEM) extremely easy to use and was very impressed with the way in which it disguises the unfriendly hardware and operating systems lurking under the surface."
Peter Bright Feb 1985 **PERSONAL COMPUTER WORLD**

"The electronics in the machine are a work of art ... The heart of the 520ST is a Motorola 68000, one of the most powerful 16-bit processors around and in many respects it is close to being a 32-bit chip ... when the machine appears in the shops, I'll be at the front end of the queue to buy one."
Peter Bright June 1985 **PERSONAL COMPUTER WORLD**

"This machine is significantly more powerful than an IBM PC ... If it's possible to design a sure-fire winning machine, this is it."
May 11th 1985 **PERSONAL COMPUTER NEWS**

"... the use of GEM makes the new range of Atari computers so similar to the Macintosh (with the added attraction of colour), that they are already being called 'Jackintoshes'."
May 2nd 1985 **COMPUTING**

"The new Atari ST computers truly represent to the consumer what Jack Tramiel is saying — easy-to-use computing power without the price." March 1985 **ANALOG COMPUTING**

"It (the ST) uses the most modern technology that is affordable, in a package that gives a professional impression."
May 23rd 1985 **POPULAR COMPUTING WEEKLY**

"The Atari ST is one of the most elegant designs I have seen ... Atari has used an original and elegant method of memory management which should make the ST faster than any other PC on the market - in any price bracket ... The 64K dollar question is would I go out and spend money for one? To which the only answer is 'Try and stop me!'"
John Lambert July 1985 **ELECTRONICS & COMPUTING**

"The 520ST is technically excellent ... The 520ST hardware is the new standard by which others will be judged."
July 1985 **YOUR COMPUTER**

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Do you already own a computer
If so, which one do you own?



Flexi-Basic

This program is available on Telsoft.

Damian McComb with a CBM-64 program which allows you to change the vocabulary of your micro. Programs can thus be made easier to read and more statements can be fitted onto one line.

Imagine programming your Commodore 64 in French, Spanish, German, or any language you desire. Or simply programming in your own personalised version of Basic. This is now possible with the help of Flexi-Basic.

What the program does is provide you with a Basic-keyword editor with which you can modify or alter any of the Commodore 64's 76 Basic commands, operators and functions. For example you could change the End statement to Terminate, the Goto statement to Jump, the For and Next commands to Loop and Endloop, the + and − operators to Plus and Minus, or the Len function to Length.

Programs written in ordinary Commdore Basic can be listed and edited in a newly defined Basic, making them easier to read and understand. Another use for the program is in fitting more statements onto one line. With Commodore Basic each statement takes at least two characters in its abbreviated form, which limits the number of statements per line.

If you re-define some or all of the statements to just one letter, such as P for Poke then far more statements can be fitted onto a single line. Then the program can be listed using ordinary Commodore keywords.

The only limitations on the new keywords are that they must have at least one but no more than 10 letters or characters, and only the alphabet and Ascii characters, except space, may be used.

Once a new set of commands has been defined the full Ram is available to the user — 38K. The program only takes up 11 bytes from 695 to 795. This is because the new keywords are stored in the Ram under the Basic Rom.

When the program is run you will see the list of Basic keywords on the screen under a heading Old. This list shows the original Commodore keywords for reference while editing. This list is repeated under another heading New. The New list represents your redefined version of the Basic keywords and can be edited and changed.

A black cursor flashes round the current New keyword being edited. This cursor can be moved up and down the list with the F1 and F3 function keys. If you move over the edge of the list in either direction, a second screen of keywords appears which can be edited in the same way. You can move between the two sets of 38 keywords by moving over the edge of either list.

Together, both screens contain the keywords of all 76 Basic statements. To edit a particular keyword press E when the cursor is flashing over the required keyword. The "cell" is then cleared and the cursor changes colour to cyan to show that you are in edit mode. You can now enter the new keywords which will appear inside the cursor "box".

You may use the delete key for any mistakes. After typing

Listing 1.

```
0 REM -----------------------
1 REM
2 REM   FLEXI-BASIC  1.0
3 REM
4 REM  BY  DAMIAN MC COMB
5 REM
6 REM       (C) 1985
7 REM
8 REM -----------------------
10 POKE56,28+4:CLR:PRINT"(CLR)PLEASE WA
IT  [    ]"
20 Z=48:X=1:C=9:V=7:B=16:N=2000:P=30720
30 READZ$:IFZ$=""THENSYS39043
40 PRINT"(HOME)"TAB(14)"    (HOME)"TAB(1
4)RIGHT$(STR$(N),LEN(STR$(N))-1)
50 Q=0:FORT=1TO63STEP2:X$=MID$(Z$,T,2):
GOSUB100:POKEP,L:P=P+X:Q=Q+L:NEXTT
60 X$=MID$(Z$,65,2):GOSUB100:CK=L:X$=RI
GHT$(Z$,2):GOSUB100:CK=CK+L*256
70 IFCK<>QTHENPRINT"(HOME)(DOWN)(DOWN)?
DATA ERROR IN LINE"PEEK(63)+256*PEEK(64
):END
80 N=N-X:GOTO30
100 G=ASC(X$)-Z:H=ASC(RIGHT$(X$,X))-Z:L
=H+(H>C)*V+B*(G+(G>C)*V):RETURN
1000 DATA 0000007FFFFF7FFFFF7FFFFF7FFFF
F7FFFFF7FFFFF7FFFFF000000FFFFFFFFFFAA16
1010 DATA FFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFE01F
1020 DATA 00003FFFFF0FFFFF0FFFFF0FFFFF0
FFFFF0FFFFF0FFFFF0F00003FFFFFFFFFFFAA10
1030 DATA FFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFE01F
[illegible]
```

in the new keyword press Return and the cursor will change back to black showing that the new keywords has been stored. If you press Return with an empty 'cell' then the contents are unchanged and the original keyword is displayed.

Pressing F7 brings you into a menu with the following options:

1. SAVE TO TAPE
2. LOAD FROM TAPE
3. SAVE TO DISC
4. LOAD FROM DISC
5. EXIT TO BASIC
6. BACK TO EDITOR

The first four options allow you to save and load complete sets of re-defined keywords on tape and disc. Each option requires you to type in the filename. For tape operations the filename may be empty. Pressing 6 will return you to the editor.

Pressing 5 will allow you to exit from the program and use your new commands or list programs in your modified Basic. However, because of the way the Commodore 64's Basic interpreter works you cannot use more than 256 characters in total in your new keywords. If you have used more than this, the program will tell you by how many you must reduce this total.

When using your new Basic you can abbreviate the commands in the usual way. For example if you have a command called Display, simply type in D shift I.

Switching between ordinary Commodore Basic and your new Basic is very easy.

To switch to ordinary Basic:

POKE 700, 1

To switch to your new Basic:

POKE 700, 0

Remember to use your new version of the Poke command if you have changed it. The program is available on tape at £3.50. Write to Damian McComb, 23 Woodlawn Drive, Dungannon, BT70 1AJ.




```
[illegible]
```

"Take a ringside seat and sample the excitement"

CLIFF HANGER

by New Generation

This fighter doesn't use his fists, man, – but everything else in sight! Cannons, boulders, boomerangs and bombs all come in handy for Cliff who has to do *something* to stop the bandit shooting up the canyon.

Spectrum 48K £4.95

GRUMPY GUMPHREY SUPERSLEUTH

by Gremlin Graphics

Keep your eye on the clock and look sharp! All your best moves have to be executed on time or you're in big trouble. Catch the shop thieves and above all keep the Manager happy – my motto exactly!

Spectrum 48K £7.95

MINI OFFICE

by Database

Comprising word processor – for writing letters and reports, a database – for storing addresses, and a spreadsheet – for storing complicated numbers. Pretty high-powered stuff, don't you think?

BBC £5.95

MAD DOCTOR

by Creative Sparks

As Mad Doctor, in this blood-curdingly evil game, the player must create new life out of freshly killed body parts. If he arouses the villagers' suspicions, they'll kill him. A light touch on the scalpel is required.

Commodore 64 £8.95

...ckout games for fans ...ywhere'

MARSPORT

by Gargoyle Games

Box your way out of this one! The World needs a Champion (what about me?) Yes, but *you* can be the champ here. That is *if you sneak the* defence plans from the doomed city and reinforce the force sphere. Not easy, with aliens attacking your every move.

Spectrum 48K and Amstrad £9.95

DYNAMITE DAN

by Mirrorsoft

Count to ten and concentrate. You think you can win on points? Well I tell you this game will have you reeling! He may not be a Jumbo or a Bonecrusher, but one thing is certain, Dynamite Dan is hard to beat.

Spectrum 48K £6.95

Amstrad and Commodore 64 £8.95

"Games to keep you on your toes".

RED ARROWS

by Database

These guys can sure move. But their game is a non-contact sport, if you get my drift. You can try your hand at formation flying, looping the loop and all the other tricks. Duck, dive, dodge, swerve and break – only don't hit anyone here.

Versions for most machines.

Cassette £8.95

Disk £11.95 & £12.95

SPOT THE BALL

by Creative Sparks

Two sports classics in one pack, but you only play one at a time, OK? There's soccer and snooker. Both need skill and timing as well as a joystick and 32K ram. Go to it!

Atari 32K £8.95

SCOOBY DOO

by Elite

Slippery customers throw in the towel when this ace detective is around. With your help he can track down and solve the mystery that haunts his friends. Join the elite band and pit your wits against the spooks.

Spectrum 48K £6.95

Commodore 64 £7.95

Amstrad £8.95

SPARKLERS SPECIAL

by Sparklers

A fist full of games at a fantastic price. And nobody is pulling punches here. These games really are the greatest – anyone who disagrees will have me to reckon with! Not to mention Slurpy, Orc Attack, River Rescue and Black Hawk.

Spectrum 48K and Commodore 64

4 games for £7.50

"Non-stop thrills from start to finish"

WHO DARES WINS II

by Alligata

Only the brave survive (and the lucky). Upper cuts and left hooks are no good to you here. You need to find the ammunition dumps to knock the stuffing out of the enemy and free your friends.

Commodore 64 £7.95

Amstrad, Spectrum and Commodore 128 versions available soon.

All games featured above are available from Laskys, WH Smith and other good software stores.

Win



Spot this month's mystery microgamer and win a fantastic prize. Ten 2-pack program prizes must be won plus single game prizes for the first 100 runners up.

If you think you now the answer, send this coupon to us, no later than 14 December 1985. The first ten correct entries will each receive SCOOBY DOO and SUPER SLEUTH. 100 runners up will each receive a super game for their machine type.

I say the Mystery Microgamer is: ____________________

Send me your latest full list of software programs.

Name ____________________

Machine ____________________

Address ____________________

____

Postcode ____________ YC4

Send to: THORN EMI Computer Software Mystery Microgamer Competition, Thomson House, 296 Farnborough Road, Farnborough, Hants GU14 7NU

Last month's Mystery Microgamer was Ian McCaskill. Prizes are on their way.



Prizewinners
Andrew James, Swansea
Bobby Earl, Birkenhead
Mark Johnson, Knottingley
Stephen Hirst, Castleford
Barry Cheeseman, Swindon
Graham Langlands, Dundee
Tim Walter, Bristol
Paul Cooke, Blackpool
Robert Wooley, Peterborough
John Baxter, Coventry

BLUFFERS' GUIDE TO MICROS

Starting out in home computing? First Bytes is for you. Just write to *Your Computer* with any hardware or software problems, no matter how small or simple.

A favourite phrase with which experts love to bluff the sucker is "historical reasons". Read on, and learn what to say when such bullies kick bytes in your face.

When I played with government computers, there was an interesting hierarchy. At the top came the almost godlike Cray supercomputer, fed by a lowly IBM 370, running an operating system designed to imitate something 10 years out of date, and up at the sharp end in my office there was an electromechanical teletype.

Clatter, clatter. Deciphering the manuals, I discovered that what I wanted to do required one punched card at the start of my Fortran program. (Yes, they used punched cards. And we edited them by sticking bits of foil over unwanted holes. Men were men in those days.) Or, for *historical reasons,* I could pick the handy alternative of substituting 17 different cards for that single one. Lucky me!

Compatibility was the idea. Somewhere in this research establishment were thick, cobwebbed decks of cards, three operating systems old, which couldn't be let go out of date — so the new system was taught to reád the old cards. If historical reasons were the same in education as in computers, we'd all have to cope with English, Latin and Anglo-Saxon . . .

History brought us the Qwerty layout: once supposedly devised to slow typists to the pace of clumsy machines, it seems established forever. Early computer terminals tended to have plain typewriter keyboards with a very few special keys like Control and Escape: the effects are still entrenched in software.

For example, in days before arrow keys, the writers of programs like WordStar wanted to let people move a cursor round the screen. They used Control plus letter keys. Anyone accustomed to typing without staring at the keyboard would have thought that, obviously, you'd press Control and U to move up, Control and L to go left, and so on. The programmers, though, were apparently one-finger typists, and picked the E, S, D and X keys, presumably because they were bunched together and easy to find by eye. Just remember that E stands for Up and D for Right . . .

Now everyone has arrow keys. But word-processors get bad reviews unles they also support the old, not particularly logical key combinations — because reviewers grew up with WordStar and like its keyboard for (ahem) historical reasons. We've likewise grown up with a ridiculously American-slanted 7-bit Ascii character set: each new British computer offers an exciting challnege, as you try to work out where they've put the pound sign.



To be purged with pity and terror, look at the MS-DOS Edlin and MicroSoft Basic line editors. You can't use the arrow keys at all. You can't alter anything which has appeared on the screen: instead, editing is done by a devious process of copying characters from a "template" line. Slowly the truth dawns. On what sort of clattering display is there no way to change a once-printed line . . .? Historical reasons strike again: although they've somehow invaded microcomputers, these editors were written for use with teletypes.

The backward-looking trend continues with Apricot's "Xen", a super-fast machine which can be specially downgraded to run slothful IBM software. Will IBM compatibility be a curse on new computers, unto the fifth generation?

Santayana said "those who cannot remember the past are condemned to repeat it" — but I remember it all too well and *still* have to repeat it, every time a program insists on my hitting Control-G instead of the perfectly good Delete key . . .

Dave Langford

I COULD DO THAT

As the climax to our competition series — arcade classic re-written in Basic — this month we are asking for a version of Pacman. Once again, the rule is make it short: no more than 20 Basic program lines. You may have to make do with only one ghost and a reduced board layout.

The winner of October's competition, S. Cartwright, 21 Maelog Place, Gabalfas, Cardiff CF4 3ED, shows here how to approach the task.

```
   1 LET SCORE=0: REM SPACE INVA
DERS,USE KEYS, CAPS SHIFT=FIRE,
N=LEFT, M=RIGHT, BY S.CARTWRIGHT
CF4 3ED
   2 GO SUB 1000
 100 IF FIRE=0 THEN BORDER 0: IF
 IN 65278=190 THEN LET FIRE=1: L
ET MISX=BASEX+2
 150 IF MISY<0 THEN PRINT AT MIS
Y+1,MISX;" ": LET MISY=20: LET F
IRE=0
 155 IF FIRE=1 THEN PRINT AT MIS
Y,MISX;"*";AT MISY+1,MISX;" ": L
ET MISY=MISY-1: IF MISY=HEIGHT-1
 THEN IF A$(MISX+1)="M" THEN LET
 A$(MISX+1)=" ": LET B$(MISX+1)=
" ": LET MISY=20: LET FIRE=0: LE
T NUMI=NUMI-1: LET SCORE=SCORE+1
0: PRINT #1; AT 0,28;SCORE: IF NU
MI=0 THEN GO TO 2
 160 LET BLR=IN 32766: IF BLR<18
8 THEN IF BLR>182 THEN LET BASEX
=BASEX+(BLR-185)/2
 161 LET BASEX=BASEX-(BASEX>28)+
(BASEX<0): PRINT AT 21,BASEX;C$
 300 IF DIR=1 THEN LET A$=A$(32)
+A$( TO 31): LET B$=B$(32)+B$( T
O 31): GO TO 320
 302 LET A$=A$(2 TO 32)+A$(1): L
ET B$=B$(2 TO 32)+B$(1)
 320 IF A$(32)="M" THEN LET DIR=
0: PRINT AT HEIGHT,0;"      ": LET HEI
GHT=HEIGHT+1: GO TO 340
 330 IF A$(1)="M" THEN LET DIR=1
 340 IF UM=0 THEN LET M$=A$: LET
 UM=1: GO TO 350
 345 LET M$=B$: LET UM=0
 350 PRINT AT HEIGHT,0;M$
 500 IF HEIGHT<21 THEN GO TO 100
 600 PRINT AT 10,11; FLASH 1;"GA
ME OVER": BEEP 1,-10: BEEP 2,-24
: PAUSE 0: RUN
1000 LET NUMI=10: LET FIRE=0: LE
T UM=0: LET DIR=0: LET BASEX=14:
 LET MISY=20: LET HEIGHT=0: LET
D$=" ": LET A$="      M M M
 M M M M M M M      ": LET B$="
      U U U U U U U U U U      "
: LET M$=A$: INK 7: PAPER 0: BOR
DER 0: CLS : PRINT #1; AT 0,22;"S
CORE": RETURN : REM INITIALISE
```

THE LANGAUGE OF "C"

"C is a general-purpose programming language which features economy of expression, modern control flow and data structures, and a rich set of operators. C is not a 'very high level' language, nor a 'big' one, and is not specialised to any particular area of application. But its absence or restrictions and its generality make it more convenient and effective for many tasks than supposedly more powerful languages.

C was originally designed for and implemented on the UNIX operating system on the DEC PDP-11, by Dennis Ritchie. The operating system, the C compiler, and essentially all UNIX applications programs are written in C.

It's hard to think of a better summary of C than this paragraphs of the famous Kernighan and Ritchie book.

Above all C is a practical language — designed by programmers to be used by programmers for writing real programs. And it doesn't matter what kind of program.

(continued on next page)

THE LANGUAGE OF "C"

(continued from previous page)

It's not a language where you struggle to express your thoughts — like assembler or old Basic with no control flow; or modern Basic, Forth, Prolog, Logo, Fortran with no data structures. Nor is it a language which hems you in with theories like Pascal or Ada.

C has a reputation for speed which rests on two things. First, it is a compiled language — one where programs are translated into machine code by a compiler before being run. This makes C programs much faster than those run by an interpreter, where each line in the program is translated into machine code over and over again as the program runs.

Secondly, the facilities of the C language were designed to match the abilities of real computers — so that efficient pieces of machine code can be generated for each line in the program. This is in contrast with some languages which are waiting for new types of computer to run them efficiently.

C can be used to write many different kinds of programs in a very natural way. The chief key is the flexibility of C's data structures. It is simple to write out the data blocks needed to control a graphics chip, a sound envelope, or a disc file-control-block; then the program that uses them just follows on.

As well as the expressive power built-in to C, more power flows from the vast range of library functions available. These are functions — or subroutines — which do useful jobs and can be used freely in your own programs. For example there is a function "qsort" which sorts data into order: it's very flexible and can be used to sort many different kinds of data at the drop of a hat. There are typically well over a hundred such functions supplied with a compiler.

C has come a long way from its origins on UNIX and is now very widely available. HiSoft sell a C compiler on a wide range of home micros — the Spectrum, all the Amstrad models including the new PCW8256, MSX disc models, the Tatung Einstein, and many other computers running the CP/M operating system. There are a multitude of compilers available for the IBM PC and MSDOS computers, and almost every mini and mainframe has a C compiler.

It is usually quick and easy to move a program from one to another, although differences do exist. For this reason business programs, and even operating systems, are now often written in C rather than machine code itself. The key here is UNIX which provides an effective standard to compare versions.

Hisoft can be found at 180 High Street North, Dunstable, Beds (telephone (0582) 696421) and will be pleased to help you with questions about C. The Kernighan and Ritchie book is entitled *The C Programming Language* and published by Prentice-Hall (ISBN 0-13-110163-3): it should whet your appetite for C further, though there are lots of other good books to choose from.

Dave Howarth

MACHINE CODE

In an interview with an American computer magazine Bill Atkinson, the author of the Macintosh's drawing program, MacDraw, was at pains to point out that he had written the entire program in "hand-crafted code". In other words, he had written it in machine code. This pride may come as a surprise to commercial games programmers, who have been writing hand-crafted code all along.



Thew point of Bill Atkinson's remark, however, was that nowadays a program that has been written entirely in machine code, using an assembler, is something of a rarity. Operating systems and business application programs are increasingly written in a high level language such as C and then compiled. Even in 1981, when the BBC operating system was being developed, most of it was programmed in BCPL.

As memory prices fall, processors speed up, and compilers become more efficient, it makes more and more sense to develop software in this way. Unless a piece of code has to be particularly compact or fast, there is no need to write it in assembler. It takes longer to write and is less easy to convert for other machines.

But for home computer owners the situation is slightly different. There are several good reasons why you should at least pick up a smattering of machine code. For one thing, it will give you a much better understanding of the way your machine works. It will also allow you to access those parts of the computer that Basic cannot reach. Interrupt-driven routines, for example, can only be implemented in machine code.

More important, though, is the fact that machine code is much faster than Basic. Take, for example, the problem of moving or animating shapes on screen. It is easy enough in Basic to move a character across the screen a character space at a time. But for smooth animation shapes need to be shifted only one or two pixels at a time. For this Basic is just too slow.

The speed advantages of machine code are very substantial indeed.


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Variety is certainly the key word in this highly unusual game which has surely gone far beyond what anyone ever expected.
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Competition results

CBM-128

Anyone who has ever spent much time hooked on one game is bound to consider ways in which the game could be improved. So it is not surprising that our August competition tapped a rich vein of suggestions, along with critical analyses and outbursts of frustration. The prize was a CBM-128. To be in the running you had to send in an idea for a new screen, room, or feature in your favourite game.

The most common and dullest idea was that the combatants in Way of the Exploding Fist should be equipped with weapons. Others were more imaginative and came up with such improvements as a welly throwing event for Decathlon, an option to do a dirty foul in International Soccer and be sent off, an asteroid belt for Elite, and — from S. Barron — the inspired idea of rewriting Hunchback in the style of Ant Attack.

Best of all, we thought, was the detailed proposal for a sado-therapeutic dwarf bashing location in the adventure game Knights Quest. This wins Neil Thraves, 153A, Fullwell Ave., Barkingside, Ilford, Essex, the prize. In his entry he explained that he was maddened by being repetively told, first, "A dwarf is with you" and then — after an attempt to kill the blighter: "he dodges your blows easily and laughs". He supplied a sample text from the new location. It included such exchanges as:

SWING DWARF

The dwarf swings to and fro, trailing small sparks from his blazing beard and waving his stubby little arms.

CUT ROPE WITH SWORD

The dwarf plunges headfirst into the stone floor, and then begins to sing feebly about gold.

We also asked you to name your Top Ten commercial games.

The full results in the form of a list of the all-time top 50 games will be given in *Your Computer*'s Top 100, to be published separately in December. For the time being see table 1 for the top 10, as computed from nearly 9,000 nominations:

Table 1.

1.	Way of the Exploding Fist	Melbourne House
2	Knightlore	Ultimate
3	Ghostbusters	Activision
4	Elite	Acornsoft/Firebird
5	Hobbit	Melbourne House
6	Impossible Mission	US Gold
7	Daley Thompson's Decathlon	Ocean
8	Raid over Moscow	US Gold
9	Dambusters	US Gold
10	Pitstop 2	CBS

AMSTRAD 6128

"Put yourself in the place of someone writing a book entitled '1001 uses of a disc drive'. Now dream up an entry for it". So ran our intro to September's Amstrad 6128 competition.

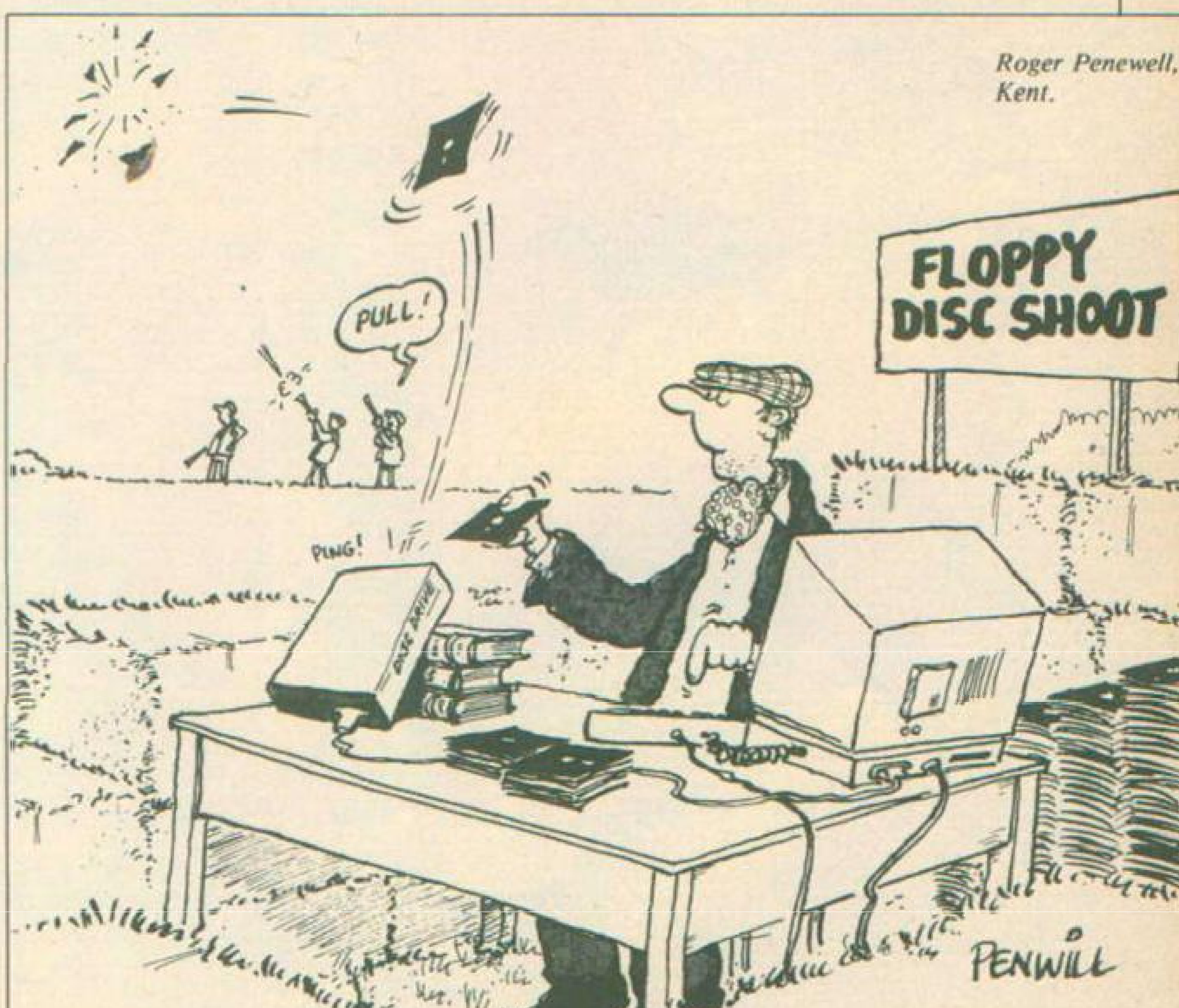
In response you sent in a number of highly sensible and constructive suggestions together with...a lot of very silly ones. Many of the latter were in the same vein as the recent story about the secretary who made back-up copies of her wordprocessing files by photocopying her discs. Since had been told that the drive ran double-sided discs she took care to photocopy both sides.

A fair number of the entries seemed preoccupied with food. Along with suggestions for using a drive as a toaster we received outlines for a Disc Drive Pizza Machine, the Bisk Drive, totally compatible with lemon curd and smooth peanut butter, and a recipe for making Ramcakes, either 40 or 80 tracks.

Other ideas included J. Higgo's explanation of how to convert a drive into a Spectrum coolant fan, and G. Pearce's Abrazor disc. With its abrasive razor surface, the Abrazor ensures that "application of beard area systematically to drive aperture activates simultaneous chin-scan and de-whisker operation".

Several other entries hit on an even more novel application: clay disc shooting. The best of these was neatly illustrated by Roger Penwill, 127 Penenden, New Ash Green, Kent DA3 8LT and wins him the Amstrad 6128.

September's Philips monitor and Mud competitions will be judged next month.



Roger Penewell, Kent.

Do you have a problem related to your micro? Our team will do their best to help. Please include only one question per letter and mark it "Response Frame". Alternatively, perhaps you have an idea you have an idea you'd like to pass on to others. Why not write to us with your top tips?

COMMODORE 64 OR AMSTRAD?

• I am thinking of buying my first micro but I can't decide between CBM-64 and Amstrad CPC-464.
Ali Imran,
Lahore,
Pakistan.

One of the main factors to consider before choosing between either machine is that they are both being superceded by superior machines built by the same manufacturers. Because of the relentless competition between manufacturers, in a few months time it should be possible to buy both the CBM-64 and the Amstrad CPC-464 at very much reduced prices.

Access to more computing power

Both the BBC and the Amstrad give access to more computing power because of their superior Basic programming languages and graphics capabilities. However, the CBM-64 should not be over-looked as a first machine especially for the purpose you mention. The 64 has a huge software base and is capable of some fairly impressive feats.

What you must decide between, therefore, is the Commodore's impressive software support and the Amstrad's conveninece with its built-in cassette unit and monitor.

But remember, both Commodore and Amstrad are releasing new, more powerful machines at prices similar to their predecessors.
Irwan Owen.

DETECTING A SPECIFIC CHARACTER

• Could you please tell me if there is a way on the Commodore 64 of detecting the specific character involved in a sprite-to-data collision e.g. in a game of Blitz, the blitz plane is a sprite, the buildings are redefined characters, and there are stars scattered above the buildings, which themselves are redefined characters. How can you tell if the sprite plane is colliding with the buildings and not the stars?
Martin Wicks,
Southampton,
Hampshire.

Unfortunately, the CBM-64 does not have a built in method for determining which screen characters a sprite has collided with.

The simple solution to your problem would be to print all the stars above the top of the line of buildings. It would then be a case of interpreting the Y-position of the sprite to decide what it must have collided with.

A more complicated approach is to convert the standard hires coordinates the sprite into character positions. This is done as follows taking into account the X and Y offsets at the edge of the screen.

x_char = INT((x − 24)/8)
y_char = INT((y − 50)/8)

These give x and y values of 1-24 and 1-40 respectively. These values can then be used in conjunction with a look-up table in the machines memory to find the address of the character square in the top left corner of the sprite. The contents of this address can then be accessed and identified.
Irwan Owen.

INSTANTANEOUS SCREENS

• Could you explain to me how I should go about making screens appear instantaneouly in machine code and also how to work it so as a loading screen can be made to appear after loading Basic.
Hadyn Seak,
Finsbury Park,
London

A quick way to make a screen is to load it higher up in the memory than usual and then dump it to screen via an Idia routine.

For example,

```
CLEAR 49150:LOAD""CODE
49151
```

then poke these values into any part of the memory.

```
33,0,229  LD HL,SOURCE
17,0,64   LD DE, DESTINATION
1,0,27    LD BC,NO OF BYLTES
          (6912)
237,176   LDIR
201       RET
RANDOMIZE USR (START OF
ROUTINE)
```

The only thing about this is that it takes the same time to load, although more spectacular, and if you intend to write a game using full screens you'll waste previous memory.

By making a loading screen appear from Basic I assume you mean as in the case of Chuckie Egg and Wheelie, where the screen is hidden in the Basic.

The best way, I find, to do this is to tack an Idir routine on the front of a screen and count the number of bytes (should be 6924). Next set up a Rem statement and put in the same amount of spaces (understand?).

For example:

```
10 REM . . . etc
```

then make the next line as follows:

```
20 FOR N = 23755 TO XXXXX:
PRINT N,PEEK N: NEXT N.
```

(Where XXXXX = any high number).

As soon as you spot a "32" code number then write the address down. Delete line 20 and load the Idir/screen into that address. Hopefully it will appear if you make lines 20/30 as follows:

```
20 BORDER X: INK X: PAPER X:
RANDOMIZE USR START
ADDRESS.
30 . . . Continue with program.
```

A slightly more efficient way to do it is to get yourself a screen compressor program and load your screen into it. The compressed program that emerges will be self contained and you can load it back to any part of the memory you wish, including the basic. A quick Rand USR et voila!
Craig Rawston.

TOP TIPS

With this program for the BBC or Electron you can display letters at any angle on the screen either slightly smaller than normal or up to ten times larger. The prgram starts by asking for the word you wish to print, followed by the new size and angle.

L. Edmond.

```
10 MODE1:INPUT "WORD";WO$
20 INPUT"SIZE (0.60-10)";SI
30 INPUT"ANGLE (-8 TO 8)";DE
35 CLS:PRINTTAB(0,0),WO$
40 IN=32*LEN(WO$)
45 Q=(1279-IN*SI)/2
50 PROClitler:END
60 DEFPROClitler
70 FOR H=1 TO IN STEP 4
80 ANG=ANG+DE
90 FOR G=994 TO 1023 STEP 4
100 X=H*SI+Q:Y=G*SI+ANG-SI*1000
+300
105 GCOL0,2
110 IF POINT(H,G)<>0 GCOL0,2:DR
AW X,Y:ELSE GCOL0,0:MOVE X,Y
120 NEXT G,H:ENDPROC
```

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Software File

PRO SYNTH

▶Andrew Parker ● CBM-64 ● Warrington, Cheshire

This program allows you to use the keyboard as a sort of musical instrument. The keyboard is from Z to / and from Q to *. This gives a span of three octaves. Sharps are S,D,G,H,J,L,:,2,3,4,6,7,9,0,+.

When the program is running, a sprite "hand" is visible. This is moved by a joystick in port 2. Placing the finger on the hand over a plus or minus sign causes the connected value to change by +1 or −1 repsectively. This works with the Envelope and Pulse Width Resolution (PWR). With the Oscillator 3 frequency, pressing the fire button allows the function keys to alter the frequency. This is because the frequency can be between 0 and 65535 Hz.

Programs for Software File should be fairly compact and sent on a cassette. Please include clear instructions and say what computer it's for. We pay between £6 and £36 for programs published. They must be double-checked and submitted to *Your Computer* exclusively.

Therefore, the function keys either add (+) or subtract (−) the following values:
F1 = +/−1 F3 = +/−10 F= +/− 100 F7 = +/− 1000 (Hz)

This allows rapid changes of the frequency. When the required frequency is set, pressing Inst/Del returns to the keyboard. This frequency only applies when ring modulation or synchronization is working.

Waveforms are selected by placing the finger on the required waveform and pressing the button. Reversed characters shown correct selection. Ring modulation and synchronization (RM and SY) are selected in the same way. To turn off, repeat the process. Note that if one is selected while the other is still on, it will be turned off.

Oscillator control shows which voices are working, either voice one voice or both.

ADSR: Attack, Decay, Sustain, Release. The four parts of a standard envelope generator. The note rises to a peak, decays to a sustain level, then dies way.

MODULATION: Application of a control voltage, for example a low frequency oscillator (LFO) to control an element in the shaping of a sound. In other words, the use of one control to influence or alter the effects of another.

RING MODULATION: As MODULATION, producing an output equal to the sum and difference of the two input frequencies. Produces some bell sounds.

SYNCHRONIZATION: Combining two notes without altering their pitch.

Listing 1.

```
5 DIMNO(70,2):PRINTCHR$(14)
10 POKE53280,6:POKE53281,0
70 FORDE=1TO4000:NEXT
150 PRINT"(CLR)  (SH E)NVELOPE":PRINT"(PUR)  (C=A)(SH
*)(C=R)(SH *)(C=R)(SH *)(C=R)(SH *)(C=S)"
160 PRINT"(HOME)(DOWN)":FORL=1TO16:PRINT"(PUR)  (C=Q)
(SH +) (SH +) (SH +) (C=W)":NEXT  .
170 PRINT"(HOME)(DOWN)(DOWN)15(DOWN)(DOWN)(DOWN)(DOWN)
(DOWN)(LEFT)(LEFT)10(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(LEF
T)5(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(LEFT)0"
180 PRINT"  (SH -)(SH A)(SH -)(SH D)(SH -)(SH S)(SH -)
(SH R)(SH -)"
190 PRINT"  (C=Q)(SH *)(SH +)(SH *)(SH +)(SH *)(SH +)(
SH *)(C=W)(DOWN)(LEFT)(LEFT)(LEFT)(LEFT)(LEFT)(LEFT)(L
EFT)(LEFT)(LEFT)(SH -)+(SH -)+(SH -)+(SH -)+(SH -)(DOW
N)(LEFT)(LEFT)(LEFT)(LEFT)(LEFT)(LEFT)(LEFT)(LEFT)(LEF
T)(C=Q)(SH *)(SH +)(SH *)(SH +)(SH *)(SH +)(SH *)(C=W)
";
195 PRINT"(DOWN)(LEFT)(LEFT)(LEFT)(LEFT)(LEFT)(LEFT)(L
EFT)(LEFT)(LEFT)(SH -)-(SH -)-(SH -)-(SH -)-(SH -)(DOW
N)(LEFT)(LEFT)(LEFT)(LEFT)(LEFT)(LEFT)(LEFT)(LEFT)(LEF
T)(C=Z)(SH *)(C=E)(SH *)(C=E)(SH *)(C=E)(SH *)(C=X)"
200 PRINT"(HOME)"SPC(12)"(SH W)AVEFORM (SH C)ONTROL
(SH P)(SH W)(SH R)    "
210 PRINTSPC(35)"(GRN)(C=A)(SH *)(C=S)"
215 PRINTSPC(12)"(GRN)(C=A)(SH *)(SH *)(C=R)(SH *)(SH
*)(C=R)(SH *)(SH *)(C=R)(SH *)(SH *)(C=S)    (C=A)(SH *
)(SH *)(SH *)(SH *)(SH *)(C=R)(C=W)+(SH -)"
220 PRINTSPC(12)"(GRN)(SH -)(WHT)(SH T)R(GRN)(SH -)(YE
L)(SH S)A(GRN)(SH -)(CYN)(SH P)U(GRN)(SH -)(PUR)(SH N)
O(GRN)(SH -)    (SH -)     %(SH -)(C=Q)(SH *)(C=W)"
225 PRINTSPC(12)"(GRN)(C=Z)(SH *)(SH *)(C=E)(SH *)(SH
*)(C=E)(C=R)(C=R)(C=E)(SH *)(SH *)(C=X)    (C=Z)(SH *)(
SH *)(C=R)(C=R)(SH *)(C=E)(C=W)-(SH -)"
230 PRINTSPC(12)"(GRN)          (SH -)(C=Z)(SH *)(SH *)(S
H *)(SH *)(SH *)(SH *)(SH *)(SH *)(SH *)(SH *)(C=X)(SH
 -)  (C=Z)(SH *)(C=X)"
235 PRINTSPC(12)"(GRN)          (C=Z)(SH *)(SH *)(SH *)(S
H *)(SH *)(SH *)(SH *)(SH *)(SH *)(SH *)(SH *)(SH *)(C
=X)"
240 PRINT"(HOME)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(D
OWN)(DOWN)(DOWN)"SPC(12)" (SH C)ONTROL    (SH O)SC.3 (
SH F)REQ"
250 PRINTSPC(12)" (YEL)(C=A)(SH *)(SH *)(C=R)(SH *)(SH
 *)(C=S)    (C=A)(SH *)(SH *)(SH *)(SH *)(SH *)(SH *)(S
H *)(SH *)(SH *)(C=R)(C=R)(SH *)(C=S)"
255 PRINTSPC(12)" (YEL)(SH -)(WHT)(SH R)(SH M)(YEL)(SH
 -)(GRN)(SH S)(SH Y)(YEL)(SH -)    (SH -)         (SH H)Z
(SH -)(SH -)+(SH -)"
260 PRINTSPC(12)" (YEL)(C=Z)(SH *)(C=R)(C=E)(C=R)(SH *
)(C=X)    (C=Z)(SH *)(SH *)(SH *)(C=R)(SH *)(C=R)(SH *)
(SH *)(SH *)(C=E)(SH +)(SH *)(C=W)"
265 PRINTSPC(12)"(YEL)    (SH -) (C=Z)(SH *)(SH *)(SH *
)(SH *)(SH *)(SH *)(SH *)(SH *)(SH *)(C=X) (SH -)    (
SH -)-(SH -)"
270 PRINTSPC(12)"(YEL)    (C=Z)(SH *)(SH *)(SH *)(SH *)
(SH *)(SH *)(SH *)(SH *)(SH *)(SH *)(SH *)(SH *)(SH *)
(C=X)    (C=Z)(SH *)(C=X)"
280 PRINT:PRINT:PRINT
290 PRINTSPC(12)"(SH O)SCILLATOR (SH C)ONTROL"
295 PRINTSPC(12)"(PUR)    (C=A)(SH *)(SH *)(SH *)(C=R)(
SH *)(SH *)(SH *)(C=S)"
300 PRINTSPC(12)"(PUR)    (SH -)(WHT)(SH O)NE(PUR)(SH -
)(YEL)(SH T)WO(PUR)(SH -)"
305 PRINTSPC(12)"(PUR)    (C=Z)(SH *)(SH *)(SH *)(C=E)(
SH *)(SH *)(SH *)(C=X)"
400 DATA3,0,0,7,128,0,3,192,224,1,225,224,0,241,192,0,
121,192,0,127,192,3,255
405 DATA192,7,255,192,7,207,192,1,243,192,15,253,224,1
5,254,224,15,159,216
410 DATA1,239,184,7,247,112,7,254,224,7,253,192,0,11,1
28,0,7,0,0,0,0
415 POKE2040,13
420 FORL=0TO62:READA:POKE832+L,A:NEXT
430 V1=53248:V2=54272
440 POKEV1+21,1:POKEV1+39,1
500 DATA12,4,48,23,4,180,20,5,71,31,5,152,28,6,71,39,7
,12,36,7,233,47,8,97
505 DATA44,9,104,55,10,143,62,11,48,9,12,143,14,14,24,
17,15,210,22,16,195,25
510 DATA18,209,30,21,31,33,22,96,38,25,30,41,28,49,46,
31,165,49,33,135,13,4,112
520 DATA11,14,239,19,17,195,24,19,239,32,23,181,35,26,
156,40,29,223,42,8,225
525 DATA18,4,251,59,11,218,8,13,78,26,5,237,29,6,167,3
4,7,119,45,9,247,-1,-1,-1
530 READA,B,C
535 IFA=-1ANDB=-1ANDC=-1THEN600
540 NO(A,1)=B:NO(A,2)=C:GOTO530
600 S=54272:POKES+24,15
610 X=152:Y=214
620 AT=10:DE=8:SU=10:RE=9
```

(continued on next page)

File

(continued from previous page)

```
630 WA$="P":SY=0:RM=0:PW=50:OF=30000:HF=116:LF=255:S1=
1:S2=0
690 D$="(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOW
N)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOW
N)(DOWN)(DOWN)(DOWN)(DOWN)"
700 PA=17-AT:PD=17-DE:PS=17-SU:PR=17-RE
710 PRINT"(HOME)(RIGHT)(RIGHT)(RIGHT)";LEFT$(D$,PA)"(W
HT)(SH *)":PRINT"(HOME)(RIGHT)(RIGHT)(RIGHT)(RIGHT)(RI
GHT)";LEFT$(D$,PD)"(WHT)(SH *)"
720 PRINT"(HOME)(RIGHT)(RIGHT)(RIGHT)(RIGHT)(RIGHT)(RI
GHT)(RIGHT)";LEFT$(D$,PS)"(WHT)(SH *)":PRINT"(HOME)(RI
GHT)(RIGHT)(RIGHT)(RIGHT)(RIGHT)(RIGHT)(RIGHT)(RIGHT)(
RIGHT)";LEFT$(D$,PR)"(WHT)(SH *)"
725 PRINT"(HOME)(DOWN)(DOWN)(DOWN)"SPC(12)"(GRN)(SH -)
(WHT)(SH T)R(GRN)(SH -)(YEL)(SH S)A(GRN)(SH -)(CYN)(SH
 P)U(GRN)(SH -)(PUR)(SH N)O(GRN)(SH -)"
730 IFWA$="T"THENPRINT"(HOME)(DOWN)(DOWN)(DOWN)"SPC(13
)"(RVS)(WHT)(SH T)R(OFF)":WA=17+4*(ABS(RM=1))+2*(ABS(S
Y=1))
735 IFWA$="S"THENPRINT"(HOME)(DOWN)(DOWN)(DOWN)"SPC(16
)"(RVS)(YEL)(SH S)A(OFF)":WA=33+4*(ABS(RM=1))+2*(ABS(S
Y=1))
740 IFWA$="P"THENPRINT"(HOME)(DOWN)(DOWN)(DOWN)"SPC(19
)"(RVS)(CYN)(SH P)U(OFF)":WA=65+4*(ABS(RM=1))+2*(ABS(S
Y=1))
745 IFWA$="N"THENPRINT"(HOME)(DOWN)(DOWN)(DOWN)"SPC(22
)"(RVS)(PUR)(SH N)O(OFF)":WA=129+4*(ABS(RM=1))+2*(ABS(
SY=1))
760 IFRM=1THENPRINT"(HOME)";LEFT$(D$,11)SPC(14)"(RVS)(
WHT)(SH R)(SH M)(OFF)"
765 IFRM=0THENPRINT"(HOME)";LEFT$(D$,11)SPC(14)"(WHT)(
SH R)(SH M)"
770 IFSY=1THENPRINT"(HOME)";LEFT$(D$,11)SPC(17)"(RVS)(
GRN)(SH S)(SH Y)(OFF)"
775 IFSY=0THENPRINT"(HOME)";LEFT$(D$,11)SPC(17)"(GRN)(
SH S)(SH Y)"
785 IFS1=1THENPRINT"(HOME)"LEFT$(D$,20)SPC(16)"(RVS)(W
HT)(SH O)NE(OFF)"
790 IFS1=0THENPRINT"(HOME)"LEFT$(D$,20)SPC(16)"(WHT)(S
H O)NE"
795 IFS2=1THENPRINT"(HOME)"LEFT$(D$,20)SPC(20)"(RVS)(Y
EL)(SH T)WO(OFF)"
800 IFS2=0THENPRINT"(HOME)"LEFT$(D$,20)SPC(20)"(YEL)(S
H T)WO"
820 GOSUB2000:GOSUB3000:GOSUB3100
825 POKEV2+14,F1:POKEV2+15,F2
830 POKEV1+16,HX:POKEV1,LX:POKEV1+1,HY
835 POKEV1+14,LF:POKEV1+15,HF
900 AD=16*AT+DE:SR=16*SU+RE
905 B1=PW*40.95
910 IFB1<255THENPL=B1:GOTO920
915 PL=255:PH=(B1-PL)/256
930 POKEV2+2,PL:POKEV2+3,PH:POKEV2+5,AD:POKEV2+6,SR
940 IFS2=0THEN1000
950 POKEV2+9,PL:POKEV2+10,PH:POKEV2+12,AD:POKEV2+13,SR
1000 KE=PEEK(197):J=PEEK(56320)
1003 POKEV2+14,LF:POKEV2+15,HF
1005 IFJ<>127THEN4000
1010 IFNO(KE,1)=0THEN1000
1020 POKEV2+1,NO(KE,1):POKEV2,NO(KE,2)
1025 IFS2=0THEN1040
1030 POKEV2+8,NO(KE,1):POKEV2+7,NO(KE,2)
1040 IFS1=1THENPOKEV2+4,WA
1045 IFS2=1THENPOKEV2+11,WA
1050 WAIT197,64
1060 POKEV2+4,WA-1:POKEV2+11,WA-1
1070 GOTO1000
2000 L=PEEK(56320)
2010 IFL=119ANDX<311THENX=X+8
2020 IFL=126ANDY>8THENY=Y-8
2030 IFL=123ANDX>8THENX=X-8
2040 IFL=125ANDY<247THENY=Y+8
2050 HX=INT(X/256):LX=X-(256*HX):HY=Y
2060 RETURN
3000 IFPW<10THENA1=31
3005 IFPW<100THENA1=30
3010 IFPW=100THENA1=29
3020 L$=STR$(PW)
3030 PRINT"(HOME)(DOWN)(DOWN)(DOWN)"SPC(29)"    "
3035 PRINT"(HOME)(DOWN)(DOWN)(DOWN)(WHT)"SPC(A1)L$
3040 RETURN
3100 IFOF<10THENA2=28
3105 IFOF>9THENA2=27
3110 IFOF>99THENA2=26
3115 IFOF>999THENA2=25
3120 IFOF>9999THENA2=24
3130 PRINT"(HOME)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(
DOWN)(DOWN)(DOWN)(DOWN)(DOWN)"SPC(26)"      "
3135 PRINT"(HOME)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(
DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(WHT)";SPC(A2)STR$(OF)
3140 RETURN
4000 POKE198,0:L=PEEK(56320)
4005 IFL=111THEN5000
4010 IFL=119ANDX<311THENX=X+8
4020 IFL=126ANDY>8THENY=Y-8
4030 IFL=123ANDX>8THENX=X-8
4040 IFL=125ANDY<247THENY=Y+8
4050 HX=INT(X/256):LX=X-(256*HX):HY=Y
4060 POKEV1+16,HX:POKEV1,LX:POKEV1+1,HY
4070 GOTO950
5000 REM * HAND ROUTINES *
5005 IFHY>208ANDLX<100ANDHX=0THEN5200
5010 IFHY>208THEN5300
5020 IFHY>136ANDHY<146ANDHX=0THEN5400
5025 IFHY>72ANDHY<82ANDLX<210THEN5500
5030 IFHY>64ANDHY<90ANDLX>50THEN5600
5035 IFHY>136ANDHY<162ANDLX>43ANDLX<51ANDHX=1THEN5700
5200 REM ** ADSR **
5205 IFHY>208ANDHY<218THEN5215
5210 IFHY>224ANDHY<234THEN5255
5212 GOTO760
5215 IFAT=15THEN5225
5220 IFLX>42ANDLX<50THENPRINT"(HOME)"SPC(3)LEFT$(D$,17
-AT)" (UP)(LEFT)(WHT)(SH *)":AT=AT+1
5225 IFDE=15THEN5235
5230 IFLX>56ANDLX<66THENPRINT"(HOME)"SPC(5)LEFT$(D$,17
-DE)" (UP)(LEFT)(WHT)(SH *)":DE=DE+1
5235 IFSU=15THEN5245
5240 IFLX>72ANDLX<82THENPRINT"(HOME)"SPC(7)LEFT$(D$,17
-SU)" (UP)(LEFT)(WHT)(SH *)":SU=SU+1
5245 IFRE=15THEN5255
5250 IFLX>88ANDLX<98THENPRINT"(HOME)"SPC(9)LEFT$(D$,17
-RE)" (UP)(LEFT)(WHT)(SH *)":RE=RE+1
5253 GOTO700
5255 IFAT=0THEN5265
5260 IFLX>42ANDLX<50THENPRINT"(HOME)"SPC(3)LEFT$(D$,17
-AT)" (DOWN)(LEFT)(WHT)(SH *)":AT=AT-1
5265 IFDE=0THEN5275
5270 IFLX>56ANDLX<66THENPRINT"(HOME)"SPC(5)LEFT$(D$,17
-DE)" (DOWN)(LEFT)(WHT)(SH *)":DE=DE-1
5275 IFSU=0THEN5285
5280 IFLX>78ANDLX<86THENPRINT"(HOME)"SPC(7)LEFT$(D$,17
-SU)" (DOWN)(LEFT)(WHT)(SH *)":SU=SU-1
5285 IFRE=0THEN5295
5290 IFLX>88ANDLX<98THENPRINT"(HOME)"SPC(9)LEFT$(D$,17
-RE)" (DOWN)(LEFT)(WHT)(SH *)":RE=RE-1
5295 GOTO760
5300 REM ** VOICES **
5305 IFLX>146ANDLX<170THEN5360
5310 IFLX>202THEN700
5313 IFS2=0THENS2=1:GOTO700
5320 IFS2=1THENS2=0:GOTO700
5360 IFS1=1THENS1=0:GOTO700
5370 IFS1=0THENS1=1:GOTO700
5400 REM ** RM AND SY **
5405 IFLX>152ANDLX<170THEN5430
5410 IFLX>130ANDLX<146THEN5420
5415 GOTO700
5420 IFRM=1THENRM=0:GOTO5440
5425 IFRM=0THENRM=1:SY=0:GOTO5440
5430 IFSY=1THENSY=0:GOTO5440
5435 IFSY=0THENSY=1:RM=0
5440 IFWA$="T"ANDRM=1THENWA=21
5443 IFWA$="T"ANDSY=1THENWA=19
5445 IFWA$="S"ANDRM=1THENWA=37
5448 IFWA$="S"ANDSY=1THENWA=35
5450 IFWA$="P"ANDRM=1THENWA=69
5453 IFWA$="P"ANDSY=1THENWA=67
5455 IFWA$="N"ANDRM=1THENWA=133
5458 IFWA$="N"ANDSY=1THENWA=131
5460 IFWA$="T"ANDRM=0ANDSY=0THENWA=17
5465 IFWA$="S"ANDRM=0ANDSY=0THENWA=33
5470 IFWA$="P"ANDRM=0ANDSY=0THENWA=65
5475 IFWA$="N"ANDRM=0ANDSY=0THENWA=129
5480 GOTO760
5500 REM ** WAVEFORMS **
5510 IFHY>72ANDHY<82THEN5520
5515 GOTO700
5520 IFLX>122ANDLX<136THENWA=17:RM=0:SY=0:WA$="T"
5525 IFLX>146ANDLX<162THENWA=33:RM=0:SY=0:WA$="S"
5535 IFLX>170ANDLX<186THENWA=65:RM=0:SY=0:WA$="P"
5545 IFLX>194ANDLX<210THENWA=129:RM=0:SY=0:WA$="N"
5550 GOTO700
5600 REM ** PWR **
5610 IFLX>50ANDLX<60THEN5620
5615 GOTO700
5620 IFHY>64ANDHY<74ANDPW<100THENPW=PW+1
```

(continued from page 116)

```
5625 IFHY>80ANDHY<90ANDPW>0THENPW=PW-1
5630 GOSUB3000
5650 IFPEEK(56320)=111THEN5620
5660 GOTO700
5700 REM ** OSC.3 FREQ **
5710 IFHY>152ANDHY<162THEN5800
5715 IFHY>136ANDHY<146THEN5725
5720 GOTO700
5725 K1=PEEK(197)
5730 IFK1=4ANDOF<65534THENOF=OF+1
5735 IFK1=5ANDOF<65524THENOF=OF+10
5740 IFK1=6ANDOF<65434THENOF=OF+100
5745 IFK1=3ANDOF<64534THENOF=OF+1000
5750 IFK1=0THEN5800
5755 GOSUB3100
5760 GOTO5725
5800 K1=PEEK(197)
5805 IFK1=4ANDOF>1THENOF=OF-1
5810 IFK1=5ANDOF>10THENOF=OF-10
5815 IFK1=6ANDOF>100THENOF=OF-100
5820 IFK1=3ANDOF>1000THENOF=OF-1000
5830 IFK1=0THEN5900
5835 GOSUB3100
5840 GOTO5800
5900 IFOF>255THEN5950
5905 LF=OF:HF=0:GOTO700
5950 LF=255:IM=OF-255:HF=IM/256
5955 GOTO760
```

ULTRALIST

►*Mark Franklin ● Spectrum ● 69 The Heights, Northolt, Middlesex*

This program allows you to produce decent looking listings on an RS-232 printer, connected to the Interface I. It indents the lines so that the only things which can be seen in the left hand column are the line numbers. It also prints up page numbers for printers using single sheets of paper, and allows any number of characters per row. It lets you list out a particular range of line numbers from a program, so that there is no need to waste paper printing unwanted lines.

To enter the program, run the machine code loader given. Once you get the message "DATA OK", the loader gives you a chance to customise it to the size of your own printer. Once this is done save it to microdrive using the command:-
SAVE*"m";1;"ULTRALIST"CODE 64000,1000

The program requires four parameters in a special order. However, if only two are given, the other two will be given an assumed value. Similarly, if none are given, all four will be assumed. They are specified in a Rem statement in line 9999.

The order they are given is: Start line No, finish line no, start page no, listing width-5. They should be written with spaces between them. The last one, listing width, is the number of characters printed per line, and can be adjusted to allow room for comments on the right hand side. If this is not specified, it willbe set to the printer width value. The start page number is included so that individual pages can be printed, if only a small alterration is made to what that page previously read.

One the parameters have been entered, type RANDOMISE USR 64000

It will now begin printing. When it reaches the bottom of the sheet of paper, the boarder will go red. This is a signal that you casn set up the next sheet of paper and press any key to resume the listing.

If, at any time you wish to abort the listing, press the "A" key until the border goes blue. It will now finish printing the current line.

The program was written with the Brother EP-22 printer in mind. The pound symbol code on this printer is different to that of the Spectrum. If your printer is not like this, then POKE 64557,0 and POKE 64558,0.

Also, all graphics are printed as "?". I have included a demo program and a listing which if produced itself show the main features.

To change the operating BAUD rating, initially set at 300 Bd. Type in the following instructions:-
FORMAT "t"; Baud rate.
POKE 64212, PEEK 23747
POKE 64213, PEEK 23748

I will be pleased to answer any inquiries about the program if an SAE is sent to Mark Franklin, 69 The Heights, Northolt, Middlesex, UB5 4BP. I can also supply a ready made copy on tape for £2.00 and on Microdrive for £3.50.

Listing 1.

```
10 PAPER 0: INK 7: BRIGHT 1: BORDER 0: CLS
15 PRINT AT 0,11; INK 5;"ULTRALIST"
30 PRINT ' INK 6;"Example of parameters"
40 PRINT '"  Start line      10"
50 PRINT "  Finish line  1033"
60 PRINT "  Page no.         34"
70 PRINT "  Page width       50"
100 PRINT ''"    9999 REM 10 1033 34 50"
1000 FOR f=USR "a" TO USR "e"-1: READ a: POK
E f,a: NEXT f
1010 DATA 16,40,40,69,69,130,130,130,130,128
,128,128,128,0,0,0,64,160,160,16,16,8,43,72,
72,72,106,72,72,64,64,64
1020 PRINT AT 10,25;"  ";TAB 25;"  "
1030 RANDOMIZE USR 64000
9999 REM 10 1033 34 50
```

Listing 2.

```
 0>REM
 1985,  Mark Franklin
 10 CLEAR 63999
 15 POKE 23692,255
 20 FOR f=64000 TO 64991 STEP 16
 25 LET c=0
 30 FOR g=f TO f+15
 40 READ a
 45 IF a>500 THEN  GO TO 200
 50 LET c=c+a
 60 POKE g,a
 70 NEXT g
 80 READ a
 90 IF c<>a THEN  GO TO 200
 95 PRINT (f-64000)/16*10+1000;"
OK"
 100 NEXT f
 110 PRINT ' FLASH 1;"DATA   OK"
 130 INPUT "Enter no. of rows per li
ne on   your printer....";l
 140 POKE 64167,l-4: POKE 64775,l-5
 150 INPUT "Enter no. of rows to be
printed per page.....";r
 160 POKE 64442,r
 190 STOP
 200 PRINT  FLASH 1;"ERROR AT ";(f-6
4000)/16*10+1000: STOP
1000 DATA 237,91,123,92,33,190,253,3
4,123,92,33,114,253,6,76,126,1876
1010 DATA 35,215,16,251,237,83,123,9
2,42,75,92,43,43,126,254,13,1740
1020 DATA 32,250,35,126,254,39,40,9,
43,43,43,126,254,39,194,82,1609
1030 DATA 253,35,126,254,15,194,82,2
53,35,35,35,126,254,234,194,82,2207
1040 DATA 253,205,20,253,237,83,227,
253,56,33,205,20,253,237,83,229,2647
1050 DATA 253,56,43,205,20,253,123,5
0,226,253,56,48,205,20,253,123,2187
1060 DATA 50,224,253,126,254,13,40,5
0,195,82,253,205,223,252,11,17,2248
1070 DATA 14,39,237,83,229,253,205,0
,253,205,6,253,24,45,205,223,2274
1080 DATA 252,205,234,252,205,0,253,
205,6,253,24,31,205,223,252,205,2805
1090 DATA 234,252,205,12,253,205,6,2
53,24,17,205,223,252,205,234,252,283
2
1100 DATA 205,12,253,58,224,253,254,
71,210,82,253,55,63,205,84,253,2535
1110 DATA 229,42,229,253,34,227,253,
205,84,253,32,7,35,35,94,35,2047
1120 DATA 86,35,25,34,229,253,225,34
,227,253,175,50,225,253,103,111,2318
1130 DATA 34,222,253,33,190,1,34,195
,92,42,227,253,62,253,219,254,2364
1140 DATA 230,1,32,14,58,72,92,230,5
6,203,63,203,63,203,63,211,1794
1150 DATA 254,201,229,58,224,253,71,
5,5,197,62,32,207,30,193,16,2037
1160 DATA 248,62,80,207,30,62,97,207
,30,62,103,207,30,62,101,207,1795
1170 DATA 30,62,32,207,30,58,226,253
,79,6,0,205,248,251,62,13,1762
1180 DATA 207,30,225,62,0,50,222,253
,58,222,253,203,127,40,6,62,2020
1190 DATA 0,50,198,92,201,229,86,35,
94,35,205,231,251,62,32,229,2030
1200 DATA 207,30,225,94,35,86,213,62
,253,219,254,230,1,32,12,229,2182
1210 DATA 33,222,253,203,254,225,62,
1,50,198,92,35,34,231,253,126,2272
1220 DATA 254,58,40,6,254,203,40,2,2
4,7,229,33,222,253,203,206,2034
1230 DATA 225,254,96,202,45,252,254,
165,210,55,252,254,128,48,100,254,27
94
1240 DATA 32,210,47,252,254,13,40,11
,254,14,32,187,35,35,35,35,1486
1250 DATA 35,24,180,205,155,252,33,2
22,253,203,134,209,225,19,19,19,2187
1260 DATA 19,25,237,91,229,253,122,6
1,188,48,4,123,61,189,216,229,2095
1270 DATA 33,223,253,54,0,35,35,52,1
26,254,60,56,34,54,0,35,1304
```

(continued on page 121)

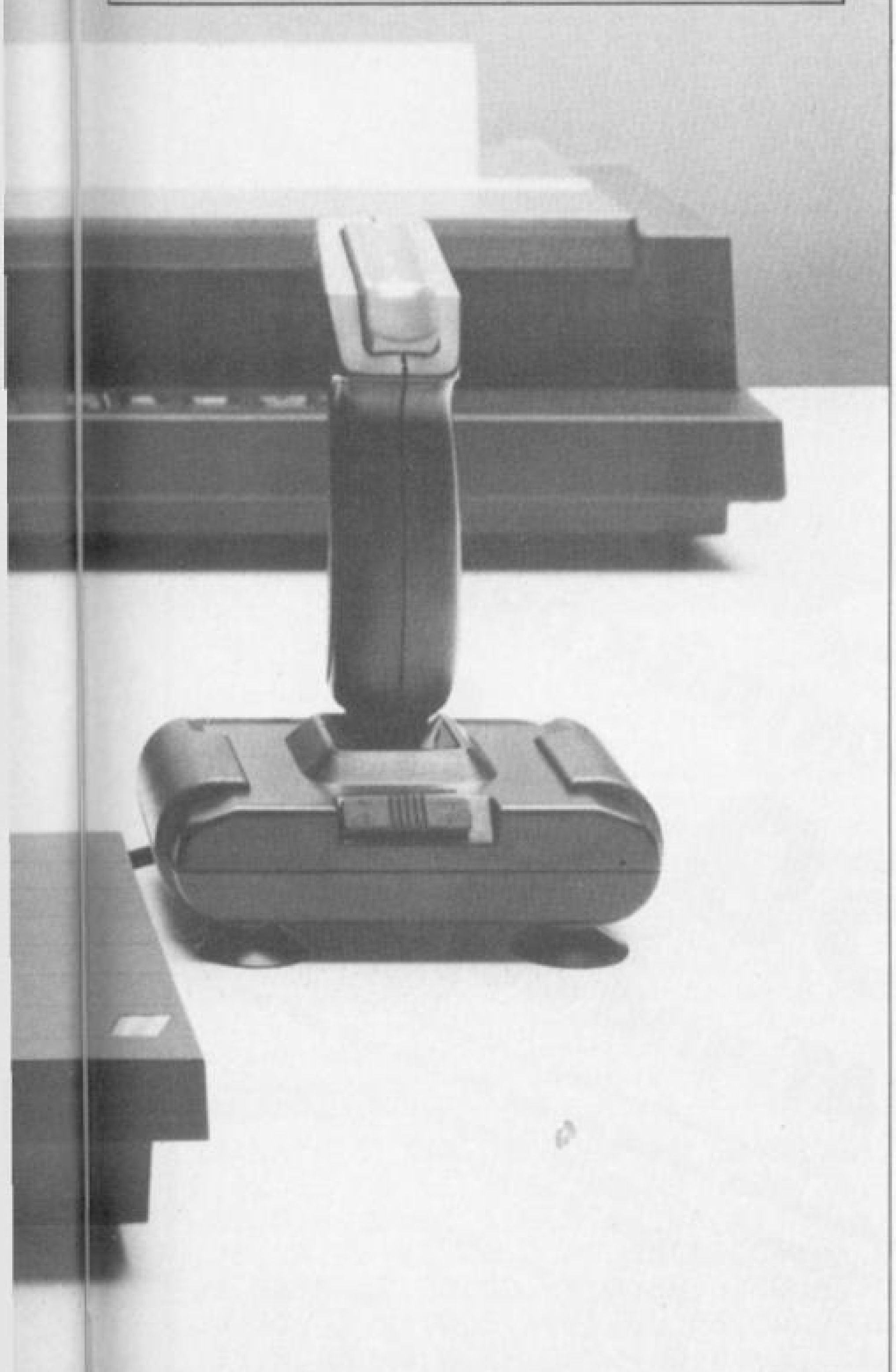


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File

(continued from page 117)

```
1280 DATA 52,62,2,211,254,175,219,25
4,230,31,254,31,40,247,58,72,2192
1290 DATA 92,230,56,203,63,203,63,20
3,63,211,254,225,195,220,250,225,275
6
1300 DATA 195,40,251,62,63,24,72,229
,235,1,24,252,205,7,252,1,1913
1310 DATA 156,255,205,7,252,229,193,
225,229,197,225,1,246,255,205,7,2087
1320 DATA 252,125,205,24,252,225,201
,175,9,60,56,252,237,66,61,40,2240
1330 DATA 12,229,33,222,253,203,198,
225,30,48,131,24,11,229,33,222,2103
1340 DATA 253,203,70,225,32,242,62,3
2,229,207,30,225,201,62,156,229,2458
1350 DATA 205,155,252,225,195,71,251
,229,245,214,165,17,149,0,205,65,264
3
1360 DATA 12,241,245,254,206,56,9,33
,222,253,203,78,32,61,24,12,1941
1370 DATA 254,202,48,55,254,199,48,4
,254,197,48,47,26,230,127,205,2198
1380 DATA 133,252,26,19,135,48,245,2
41,254,213,48,40,254,211,48,12,2179
1390 DATA 254,202,48,32,254,199,48,4
,254,168,48,24,33,222,253,203,2246
1400 DATA 142,225,195,71,251,213,205
,155,252,209,201,62,32,213,205,155,2
786
1410 DATA 252,209,24,200,62,32,205,1
55,252,24,225,207,30,33,223,253,2386
1420 DATA 126,35,60,190,32,35,35,52,
42,231,253,62,14,35,190,204,1596
1430 DATA 205,252,62,13,190,40,17,43
,190,40,13,35,207,30,6,5,1348
1440 DATA 197,62,32,207,30,193,16,24
8,175,50,223,253,201,35,35,35,1992
1450 DATA 35,35,35,201,55,63,229,197
,225,237,82,56,117,225,201,237,2230
1460 DATA 91,227,253,1,14,39,205,212
,252,201,237,75,229,253,237,91,2617
1470 DATA 227,253,205,212,252,237,91
,229,253,1,14,39,205,212,252,201,288
3
1480 DATA 62,1,50,226,253,201,62,70,
50,224,253,201,58,226,253,254,2444
1490 DATA 100,48,63,201,17,0,0,35,12
6,254,32,40,250,254,13,40,1473
1500 DATA 42,205,27,45,56,44,6,9,229
,213,225,25,16,253,209,26,1630
1510 DATA 213,214,48,95,22,0,25,235,
225,35,126,254,13,40,7,254,1806
1520 DATA 32,32,222,55,63,201,62,1,5
0,222,253,58,222,253,254,1,1981
1530 DATA 55,201,207,25,42,83,92,70,
35,78,35,94,35,86,35,229,1402
1540 DATA 42,227,253,237,66,225,56,5
,40,3,25,24,234,43,43,43,1566
1550 DATA 43,201,16,5,19,1,17,0,32,3
2,32,32,32,32,32,32,558
1560 DATA 32,32,32,85,76,84,82,65,76
,73,83,84,32,32,32,32,932
1570 DATA 32,32,32,32,32,32,16,5,144
,146,16,7,32,32,32,32,654
1580 DATA 32,32,32,127,32,32,77,97,1
14,107,32,70,114,97,110,107,1212
1590 DATA 108,105,110,32,32,32,32,32
,32,32,16,6,145,147,16,40,917
1600 DATA 40,69,69,130,130,130,130,1
28,128,128,128,0,0,0,64,160,1434
1610 DATA 160,16,16,8,43,72,72,72,10
6,72,72,64,64,64,0,0,901
```

SCREEN DUMP

▸*Nick Godwin • Amstrad • Eyemouth, Berwickshire*

Since I obtained a Brother M-10009 printer I have, of course, been plugging-in various routines to try and fully utilise its capabilities. However, because for some reason beyond my comprehension the Amstrad CPC-464 does not send bit 7 to the printer, some 50 per cent of the excellent printer characters are unavailable to me. In fact, I can't even get the printer's £-sign!

I therefore quickly became interested in the idea of a screen-dump, and have been plugging in every such program that I have been able to find. However, I was unable to find one that satisfied my needs, so I decided to knuckle down and write my own.

This screen dump is different from most in that it is designed for A4 size paper, somewhat wider than usual. Also, rather that dumping the whole screen, it dumps one line only, which is selected by sending a parameter — the line-number — to the machine-code. The whole screen can therebye be dumped from Basic, if required, or any line or set of lines that you may happen to require. The parameter can be either a constant or a variable.

In order to make up the additional width, I have arranged for the four horizontal bits that must be interpreted from the display to be translated into six bits to be set to the printer. In order to retain squareness, I matched this vertically, so that each printed character is in fact twelve bits high rather than the usual eight. This has resulted in a "chunky" look which I find rather nice. Line-drawings, such as circles and squares, are therefore true in shape.

The Basic Loader enables the machine code to be placed anywhere in Ram above Himen — space is reserved if necessary. The complete code and variables occupies 253 bytes. Provision is also made for printers with a minimum line-feed unit of 1/36", instead of the 1/72" that is available to me — in fact, the M-10009 has a minimum line-feed capability of 1/216", but I do not use that in this routine.

Because the printer has to make two passes for each line of print, the net printing speed is reduced accordingly, but this is more than compensated for by the additional graphics capability. In fact, anything that can be displayed on the screen can be copied to the printer. Note, however, that the graphics origin must be 0,0 before the machine code is called.

The machine code does not assume ink 0 to be the paper ink, but tests to see what ink the paper is set to. That is the only colour not printed — all other inks are dumped.

Listing 1.

```
10 DATA DD,6E,Ø,7D,FE,1A,DØ,3E,1A,95,21,8,Ø,1,1Ø,Ø,3D,28,3,9,18,FA,E
5,3E,1B,CD,x1,Ø,3E,4Ø,CD,x1,Ø,3E,1B,CD,x1,Ø,3E,41,CD,x1,Ø,3E,6,CD,x1
,Ø,CD,x2,Ø,E1,1,8,Ø,A7,ED,42,CD,x2,Ø,3E,1B,CD,x1,Ø,3E,4Ø,C3,x1,Ø,6,4
,3E,2Ø,CD,x1,Ø,1Ø,F9,3E,1B,CD,x1,Ø,3E,4C,CD,x1,Ø
2Ø DATA 3E,2Ø,CD,x1,Ø,3E,3,CD,x1,Ø,1,8Ø,2,11,Ø,Ø,C5,D5,E5,3E,Ø,32,x4
,Ø,3C,32,x3,Ø,6,4,C5,E5,D5,CD,99,BB,4F,C5,CD,FØ,BB,C1,D1,E1,B9,23,23
,28,B,3A,x3,Ø,4F,3A,x4,Ø,81,32,x4,Ø,3A,x3,Ø,CB,27,32,x3,Ø,C1,1Ø,D7,3
A,x4,Ø,E,Ø,FE,Ø,28,28,FE,F,2Ø,4,E,3F,18,2Ø,CB,47
3Ø DATA 28,4,CB,C1,CB,C9,CB,4F,28,4,CB,C9,CB,D1,CB,57,28,4,CB,D9,CB,
E1,CB,5F,28,4,CB,E1,CB,E9,79,32,x4,Ø,CD,x1,Ø,E1,D1,C1,CB,43,28,A,CB,
4B,28,6,3A,x4,Ø,CD,x1,Ø,13,B,78,B1,C2,x5,Ø,3E,A,CD,2E,BD,38,FB,C3,31
,BD,Ø,Ø
4Ø DATA xxx
5Ø CLS:PRINT"EPSON-TYPE SCREEN DUMP by Nick Godwin":PRINT:PRINT:INPU
T"Start address (max 43651)";address:IF address >43651 OR address=Ø
THEN address=43651
```

(continued on next page)

(continued from previous page)

```
60 PRINT:PRINT"Address =";address:MEMORY address-1:FOR j=address TO
address+252:READ a$:IF ASC(a$)=120 THEN GOSUB 130:GOTO 80
70 POKE j,VAL("&"+a$)
80 NEXT j
90 PRINT:PRINT"Select the minimum line feed quantity","available on
your EPSON COMPATIBLE","printer:":PRINT:PRINT"1 ... 1/72":PRINT:PRIN
T"2 ... 1/36":PRINT
100 INPUT a:IF a=2 THEN POKE (address+44),3
110 PRINT:PRINT"SCREEN DUMP is now loaded.":PRINT:PRINT"To operate:
CALL";address;"line":PRINT:PRINT'" is CTRL H
120 END
130 IF a$="x1" THEN a=address+243
140 IF a$="x2" THEN a=address+71
150 IF a$="x3" THEN a=address+252
160 IF a$="x4" THEN a=address+251
170 IF a$="x5" THEN a=address+106
180 POKE(j+1),INT(a/256):POKE j,(a-256*INT(PEEK(j+1))):j=j+1:READ a$
:RETURN
190 n=0
200 READ a$:IF a$="xxx" THEN END ELSE n=n+1:GOTO 200
```

SCROLLS

T A Bratley • Spectrum • Grimsby, South Humberside

Here is a set of eight versatile, easily used and interesting scroll routines which can be added to your Basic programs to clear all or part of a screen in one of 8 directions.

The routines scroll one character square at a time in the following compass directions.

N, S, E, W, NE, NEW, SE, SW.

The old character square is blanked out and its attribute is replaced with one of your choice.

The difference between these and previously published routines is that any section of the screen can be scrolled in any direction and leave any colour attribute behind. This includes the bottom two lines.

There are only five parameters you have to supply in order to define the section of the screen to be scrolled, and below are the addresses you need to poke for both 16K and 48K machines. (16 in brackets)

POKE 64000, (31232), h.
(1 to 24)
POKE 64001, (31233), w.
(1 to 32)
POKE 64002, (31234), r.
(0 to 23)
POKE 64003, (31235), c.
(0 to 31)
POKE 64004, (31236), a
(attribute)

This defines a box of height h, width w, with a top left-hand corner at r,c (where r and c are the normal PRINT AT cordinates), to be replaced with a new attribute a.

Height and width most always be at least one because a box must have two dimensions, and care must be taken to see that the box does not exceed the screen limits.

The attribute is calculated in the usual way by multiplying the paper colour by eight and then adding the ink value. If bright is required add a further 64 to the total so far, and finally if Flash is required add a further 128.

After poking the values for machine code routines to use you will then have to select whichever scroll direction you require.

The table below gives you the addresses for both machines

DIRECTION	16K	48K
N	31241	64009
S	31253	64021
E	31265	64033
W	31277	64045
NE	31289	64057
SE	31303	64071
SW	31317	64085
NW	31331	64099

These routines use the values r,c (row, column) to calculate the actual memory address of the top left-hand corner of the box and its corresponding attribute address. They then take the width and height of the box and use the lower of these two valves as a loop counter within the machine code to repeatedly call the appropriate routines until the box is cleared. This saves using a For Next loop in Basic and therefore speeds up the scrolling. However, this has a slight disadvantage in that very small boxes are scrolled off so fast that the effect is lost.

Because the machine code is not relocatable I have given two decimal dumps for the for the 16K and 48K machine. The 16K version is entered at 31232 and the 48K version at 64000, and both are 654 bytes in length.

To enter the code use the decimal loader in Program 1. There is a checksum at the end to make sure no data entry errors have been made.

16K Checksum = 73333
48K Checksum = 83923

You can obtain a printout of the decimal dump by typing GOTO 1000, if an error has been made. If you have no printer change the LPrint statements to Print statements and check it on the screen. When you are sure everything is OK then save the code by typing;

16K SAVE "Scrolls' Code 31232, 654
48K SAVE "Scrolls" Code 64000, 654

To load the code CLEAR 31231 for a 16K or 63999 for a 48K, then Load "" code.

I have written a demonstration program which runs through all the routines with different size boxes to give you some idea of what the routines can do.

A good idea is to set up the parameters of the box first then load a Screen$ from a commercial game and finally run a routine to clear part of the screen. This gives you a very interesting effect, especially the diagonal scrolls.

(continued on page 125)

File

Hex loader.

```
  1Ø DEF FN h(h$)=16*(CODE h$(1)
-48-(7 AND h$(1)>"9"))+CODE h$(2
)-48-(7 AND h$(2)>"9")
  19 REM hfdhd
  2Ø INPUT "Start ";s
  3Ø INPUT "Finish ";f
  39 REM fd
  4Ø FOR n=s TO f STEP 8
  5Ø LET tot=Ø: PRINT n;": ";
  6Ø INPUT h$: PRINT h$;
  7Ø LET x=Ø
  8Ø FOR b=1 TO LEN h$ STEP 2
  9Ø LET z=FN h(h$): LET tot=tot
+z
 1ØØ POKE n+x,z
 11Ø LET h$=h$(3 TO ): LET x=x+1
 12Ø NEXT b
 13Ø PRINT " = ";: INPUT t: PRIN
T t
 14Ø IF tot<>t THEN  PRINT "inpu
t error - try again": GO TO 5Ø
 15Ø NEXT n
 16Ø REM enter STOP to stop
```

Listing 1. 16K

```
31232:  182ØØØØØØØØØØØØØ = 56
3124Ø:  ØØ3AØØ7A47C5CD7C = 777
31248:  7AC11ØF9C93AØØ7A = 961
31256:  47C5CD897AC11ØF9 = 119Ø
31264:  €93AØ17A47C5CD96 = 1ØØ5
31272:  7AC11ØF9C93AØ17A = 962
3128Ø:  47C5CDA37AC11ØF9 = 1216
31288:  C9CD717AC5CD7C7A = 1289
31296:  CD967AC11ØF6C9CD = 1338
313Ø4:  717AC5CD897ACD96 = 1251
31312:  7AC11ØF6C9CD717A = 1218
3132Ø:  C5CD897ACDA37AC1 = 1344
31328:  1ØF6C9CD717AC5CD = 13Ø5
31336:  7C7ACDA37AC11ØF6 = 1191
31344:  C93AØØ7A473AØ17A = 633
31352:  B8DØ47C9CDD47ACD = 14Ø8
3136Ø:  BØ7ACDØF7CCD4F7B = 1Ø49
31368:  C9CDD97ACDB57ACD = 1458
31376:  437CCD797BC9CDD4 = 1258
31384:  7ACDBØ7ACDD77BCD = 1373
31392:  Ø17BC9CDD47ACDBØ = 1245
314ØØ:  7ACDA57BCD2C7BC9 = 1188
314Ø8:  3AØ27A18Ø93AØØ7A = 395
31416:  3D4F3AØ27A8121ØØ = 484
31424:  58A728Ø747112ØØØ = 422
31432:  191ØFD3AØ37A856F = 721
3144Ø:  22Ø77AC93AØ27A18 = 57Ø
31448:  Ø93AØØ7A3D4F3AØ2 = 389
31456:  7A8121ØØ4ØA7281Ø = 571
31464:  47112ØØØ197DFE2Ø = 556
31472:  3ØØ47CC6Ø7671ØF4 = 744
3148Ø:  3AØ37A856F22Ø57A = 588
31488:  C92AØ77A2B3AØ17A = 596
31496:  5F16ØØ193AØØ7A47 = 393
315Ø4:  C5E5E5D12BØ6ØØ3A = 971
31512:  Ø17A3D4FEDB8233A = 777
3152Ø:  Ø47A77E1112ØØØ19 = 544
31528:  C11ØE5C92AØ77A3A = 868
31536:  ØØ7A47C5E5E5D123 = 1Ø92
31544:  Ø6ØØ3AØ17A4FØDED = 516
31552:  BØ2B3AØ47A77E111 = 764
3156Ø:  2ØØØ19C11ØE5C92A = 738
31568:  Ø77A3AØØ7A3D473A = 499
31576:  Ø17AC5E5112ØØØ19 = 623
31584:  D1E5Ø6ØØ4FEDBØE1 = 1161
31592:  C11ØEFE5D1133D4F = 1Ø45
316ØØ:  Ø6ØØ3AØ47A77EDBØ = 722
316Ø8:  C92AØ77A3AØØ7A3D = 613
31616:  473AØ17AC5E5A711 = 862
31624:  2ØØØED52D1E5Ø6ØØ = 795
31632:  4FEDBØE1C11ØEDE5 = 1392
3164Ø:  D1133D4FØ6ØØ3AØ4 = 436
31648:  7A77EDBØC92AØ57A = 1Ø24
31656:  3AØØ7A47C5E5Ø6Ø8 = 691
31664:  C5E5E5D123Ø6ØØ3A = 963
31672:  Ø17A3D4FEDBØ2BAF = 894
3168Ø:  77E124C11ØEAE17D = 1173
31688:  C62Ø6FFE2Ø3ØØ47C = 8Ø3
31696:  C6Ø867C11ØD6C92A = 975
317Ø4:  Ø57A3AØ17A3D856F = 613
31712:  3AØØ7A47C5E5Ø6Ø8 = 691
3172Ø:  C5E5E5D12BØ6ØØ3A = 971
31728:  Ø17A3D4FEDB823AF = 894
31736:  77E124C11ØEAE17D = 1173
31744:  C62Ø6FFE2Ø3ØØ47C = 8Ø3
31752:  C6Ø867C11ØD6C92A = 975
3176Ø:  Ø57A3AØØ7A3D47C5 = 636
31768:  EB627BC62Ø6FFE2Ø = 1Ø83
31776:  3ØØ47CC6Ø867E5Ø6 = 72Ø
31784:  Ø8C5E5D5Ø6ØØ3AØ1 = 712
31792:  7A4FEDBØD1E11424 = 11Ø4
318ØØ:  C11ØEEE1C11ØD8CD = 13Ø2
318Ø8:  777CC92AØ57A3AØØ = 671
31816:  7A3D47C5EB627BD6 = 1121
31824:  2Ø6FFEEØ38Ø47CD6 = 1Ø19
31832:  Ø867E5Ø6Ø8C5E5D5 = 993
3184Ø:  Ø6ØØ3AØ17A4FEDBØ = 679
31848:  D1E11424C11ØEEE1 = 1162
31856:  C11ØD8CD777CC9Ø6 = 1Ø8Ø
31864:  Ø8C5E5E5D1133AØ1 = 95Ø
31872:  7A3D4FAF4777EDBØ = 1Ø4Ø
3188Ø:  E124C11ØECC9ØØ = 9Ø7
```

File

Listing 2. 48K

```
64000: 1820000000000000 = 56
64008: 003A00FA47C5CD7C = 905
64016: FAC110F9C93A00FA = 1217
64024: 47C5CD89FAC110F9 = 1318
64032: C93A01FA47C5CD96 = 1133
64040: FAC110F9C93A01FA = 1218
64048: 47C5CDA3FAC110F9 = 1344
64056: C9CD71FAC5CD7CFA = 1545
64064: CD96FAC110F6C9CD = 1466
64072: 71FAC5CD89FACD96 = 1507
64080: FAC110F6C9CD71FA = 1474
64088: C5CD89FACDA3FAC1 = 1600
64096: 10F6C9CD71FAC5CD = 1433
64104: 7CFACDA3FAC110F6 = 1447
64112: C93A00FA473A01FA = 889
64120: B8D047C9CDD4FACD = 1536
64128: B0FACD0FFCCD4FFB = 1433
64136: C9CDD9FACDB5FACD = 1714
64144: 43FCCD79FBC9CDD4 = 1514
64152: FACDB0FACDD7FBCD = 1757
64160: 01FBC9CDD4FACDB0 = 1501
64168: FACDA5FBCD2CFBC9 = 1572
64176: 3A02FA18093A00FA = 651
64184: 3D4F3A02FA812100 = 612
64192: 58A7280747112000 = 422
64200: 1910FD3A03FA856F = 849
64208: 2207FAC93A02FA18 = 826
64216: 093A00FA3D4F3A02 = 517
64224: FA81210040A72810 = 699
64232: 47112000197DFE20 = 556
64240: 30047CC6076710F4 = 744
64248: 3A03FA856F2205FA = 844
64256: C92A07FA2B3A01FA = 852
64264: 5F1600193A00FA47 = 521
64272: C5E5E5D12B06003A = 971
64280: 01FA3D4FEDB8233A = 905
64288: 04FA77E111200019 = 672
64296: C110E5C92A07FA3A = 996
64304: 00FA47C5E5E5D123 = 1220
64312: 06003A01FA4F0DED = 644
64320: B02B3A04FA77E111 = 892
64328: 200019C110E5C92A = 738
64336: 07FA3A00FA3D473A = 755
64344: 01FAC5E511200019 = 751
64352: D1E506004FEDB0E1 = 1161
64360: C110EFE5D1133D4F = 1045
64368: 06003A04FA77EDB0 = 850
64376: C92A07FA3A00FA3D = 869
64384: 473A01FAC5E5A711 = 990
64392: 2000ED52D1E50600 = 795
64400: 4FEDB0E1C110EDE5 = 1392
64408: D1133D4F06003A04 = 436
64416: FA77EDB0C92A05FA = 1280
64424: 3A00FA47C5E50608 = 819
64432: C5E5E5D12306003A = 963
64440: 01FA3D4FEDB02BAF = 1022
64448: 77E124C110EAE17D = 1173
64456: C6206FFE2030047C = 803
64464: C60867C110D6C92A = 975
64472: 05FA3A01FA3D856F = 869
64480: 3A00FA47C5E50608 = 819
64488: C5E5E5D12B06003A = 971
64496: 01FA3D4FEDB823AF = 1022
64504: 77E124C110EAE17D = 1173
64512: C6206FFE2030047C = 803
64520: C60867C110D6C92A = 975
64528: 05FA3A00FA3D47C5 = 892
64536: EB627BC6206FFE20 = 1083
64544: 30047CC60867E506 = 720
64552: 08C5E5D506003A01 = 712
64560: FA4FEDB0D1E11424 = 1232
64568: C110EEE1C110D8CD = 1302
64576: 77FCC92A05FA3A00 = 927
64584: FA3D47C5EB627BD6 = 1249
64592: 206FFEE038047CD6 = 1019
64600: 0867E50608C5E5D5 = 993
64608: 06003A01FA4FEDB0 = 807
64616: D1E11424C110EEE1 = 1162
64624: C110D8CD77FCC906 = 1208
64632: 08C5E5E5D1133A01 = 950
64640: FA3D4FAF4777EDB0 = 1168
64648: E124C110ECC900 = 907
```

LUCIFER

►*Olaf Astrand • Spectrum • Sweden*

First enter the Basic program and save it by using
Save "Lucifer" Linc 0

Restart your Spectrum and enter code loader run it and enter Main Code when you have done that Enter (Stop) and save code with
Save "MC" Code 46000,950

Then run code loader and enter Sprite Code. Address 40074 — 40840 Save it:
Save "SPRITES" Code 40000,850 Restart/Rewind and load all parts.

Controls Are:
Q=DROP
A=TAKE
N=LEFT
M=RIGHT
SPACE=JUMP.

```
6 LOAD ""CODE : LOAD ""CODE
7 INK 7: PAPER 0: BORDER 0: CLS
8 POKE 60000,2: POKE 60001,27: POKE 60003,208:
  POKE 60004,156
9 RANDOMIZE USR 46640: PRINT AT 3,28;"0"
10 LET DEPTH=44*8
11 LET Z=47*8+3
12 LET OX=INT ((Z-DEPTH)/8)
13 LET OY=(Z-DEPTH-OX*8)*3
14 LET OX=OX*3
15 LET Q=1
16 LET BOULDER=0
```

(continued on page 127)

(continued from page 126)

```
 17 PRINT AT 17,26;"TIME"
 18 LET MAP=45000
 19 LET INKEY=5060
 20 LET TIME=2500
 22 RANDOMIZE USR 46522
 60 GO SUB 7500
 70 GO SUB 7000
 100 REM Loop
 110: LET A$=INKEY$: GO SUB 7700
 112 IF CODE A$>96 THEN LET A$=CHR$ (CODE A$-32)
 115: IF A$="" THEN GO TO 110
 120: IF a$="A" THEN GO SUB 2000
 130: IF a$="N" THEN GO SUB 3000
 140: IF a$="M" THEN GO SUB 4000
 150: IF a$="Q" THEN GO SUB 1000
 160: IF a$=" " THEN GO SUB 5000
 170: GO SUB 7000
 180: GO SUB 6000
 185: GO SUB 7700
 190 GO TO 100
1020 IF PEEK (MAP+Z-8)<>0 THEN  GO TO 110
1030 IF BOULDER=0 THEN RETURN
1040 LET BOULDER=BOULDER-1
1044 PRINT AT 3,28;BOULDER
1050 POKE MAP+Z,2
1060 LET Z=Z-8: GO SUB 7000
1070 IF OX=15 TH. RETURN
1080 POKE 60000,(O.
1090 POKE 60001,OY
1100 POKE 60003,208
1110 POKE 60004,156
1120 RANDOMIZE USR 46640
1130 RETURN
2020 IF PEEK (MAP+Z+8)<>2 THEN  GO TO 110
2030 IF BOULDER=3 THEN RETURN
2040 LET BOULDER=BOULDER+1
2044 PRINT AT 3,28;BOULDER
2050 LET Z=Z+8
2060 POKE MAP+Z,0
2080 RETURN
3020 IF Q=1 THEN LET Q=-1: RETURN
3040 IF PEEK (MAP+Z-1)<>0 THEN RETURN
3060 LET Z=Z-1
3080 RETURN
4020 IF Q=-1 THEN LET Q=1: RETURN
4030 IF PEEK (MAP+Z+1)=8 THEN        GO TO 8000
4040 IF PEEK (MAP+Z+1)<>0 THEN RETURN
4060 LET Z=Z+1
4080 RETURN
5020 IF PEEK (MAP+Z-8)<>0 THEN GO TO 110
5030 IF PEEK (MAP+Z+Q)<>0 THEN LET Z=Z-8: GO SUB
     7000 : GO TO INKEY
5040 IF PEEK (MAP+Q+Z-8)<>0 THEN LET Z=Z-8:
     GO SUB 7000: GO TO INKEY
5050 LET Z=Z-8+Q
5055 GO SUB 7000
5060 LET A$=INKEY$
5070 IF CODE A$>96 THEN LET A$=CHR$
     (CODE A$-32)
5080 IF A$="Q" THEN IF BOULDER>0 THEN
     GO SUB 1000: LET A=0: RETURN
5090 LET A=0
5100 IF PEEK (MAP+8+Q+Z)=0 THEN IF PEEK
     (MAP+Q+Z)=0 THEN LET Z=Z+8+Q: RETU
5110 IF PEEK (MAP+Q+Z)=0 THEN LET Z=Z+Q
5130 RETURN
6020 IF PEEK (MAP+Z+8)<>0 THEN RETURN
6040 LET A$=INKEY$
6050 IF CODE A$>96 THEN LET A$=CHR$ (CODE A$-32)
6060 IF A$="Q" THEN IF BOULDER>0 THEN GO SUB
     1000: RETURN
6080 LET Z=Z+8
6090 LET A=0
6095 GO SUB 7000
6100 GO TO 6020
7010 LET NX=INT ((Z-DEPTH)/8)
7020 LET NY=Z-DEPTH-NX*8
7040 IF Q=1 THEN POKE 60004,157: POKE 60003,168
7050 IF Q=-1 THEN POKE 60004,157: POKE 60003,96
7070 LET NX=NX*3
7080 LET NY=NY*3
7100 LET X=(NX-OX)/3
7110 LET Y=(NY-OY)/3
7150 POKE 60009,OX
7160 POKE 60010,OY
7300 LET OX=OX+X
7310 LET OY=OY+Y
7340 POKE 60000,OX
7350 POKE 60001,OY
7365 RANDOMIZE USR 46822
7370 RANDOMIZE USR 46640
7390 IF NX<>OX OR NY<>OY THEN GO TO 7130
7410 IF OX=18 THEN LET OX=3: LET DEPTH=DEPTH+40:
     GO SUB 7500: GO TO 7000
7420 IF OX=0 THEN LET OX=15: LET DEPTH=DEPTH-40:
     GO SUB 7500: GO TO 7000
7440 RETURN
7510 LET H=INT (DEPTH/256)
7520 LET L=DEPTH-H*256
7540 POKE 60006,L
7550 POKE 60007,H
7570 RANDOMIZE USR 46535
7580 PRINT AT 10,26;"LEVEL"
7585 PRINT AT 11,27;DEPTH;" "
7590 RETURN
7720 LET TIME=TIME-1
7730 PRINT AT 18,26;TIME;" "
7740 IF TIME>0 THEN RETURN
7750 PRINT AT 10,3;"IT IS ALL OVER"
7760 PRINT AT 11,4;"YOUR  TIME IS UP"
7770 FOR F=1 TO 100: NEXT F
7780 POKE 60003,88: POKE 60004,159
7790 RANDOMIZE USR 46640
7800 FOR F=1 TO 10: NEXT F
7810 POKE 60003,16: POKE 60004,159
7820 RANDOMIZE USR 46640
7999 GO TO 7
8000 REM *** IOFF ***
8100 POKE 60001,3+PEEK 60001
8110 POKE 60003,24: POKE 60004,157
8120 RANDOMIZE USR 46640
8130 PRINT AT 0,0;"     CONGRATULATIONS !!
     YOU HAVE TURNED THE ILLUSION  OFF"
8135 POKE 60000,9: POKE 60001,6
8136 POKE 60009,9: POKE 60010,9:
     RANDOMIZE USR 46822
8140 POKE 60003,88: POKE 60004,159
8150 RANDOMIZE USR 46640
8160 FOR F=1 TO 10: NEXT F
8170 POKE 60003,16: POKE 60004,159
8180 RANDOMIZE USR 46640
8190 FOR F=1 TO 10: NEXT F
8200 POKE 60003,16: POKE 60004,159
8205 POKE 60000,OX: POKE 60001,OY
8210 RANDOMIZE USR 46640
8220 FOR F=0 TO 500: NEXT F
8230 GO TO 7
```

Hex loader.

```
  10 DEF FN h(h$)=16*(CODE h$(1)
-48-(7 AND h$(1)>"9"))+CODE h$(2
)-48-(7 AND h$(2)>"9")
  19 REM hfdhd
  20 INPUT "Start ";s
  30 INPUT "Finish ";f
  39 REM fd
  40 FOR n=s TO f STEP 8
  50 LET tot=0: PRINT n;": ";
  60 INPUT h$: PRINT h$;
  70 LET x=0
  80 FOR b=1 TO LEN h$ STEP 2
  90 LET s=FN h(h$): LET tot=tot
+s
 100 POKE n+x,s
 110 LET h$=h$(3 TO ): LET x=x+1
 120 NEXT b
 130 PRINT " = ";: INPUT t: PRIN
T t
 140 IF tot<>t THEN  PRINT "inpu
t error - try again": GO TO 50
 150 NEXT n
 160 REM enter STOP to stop
```

Machine code.

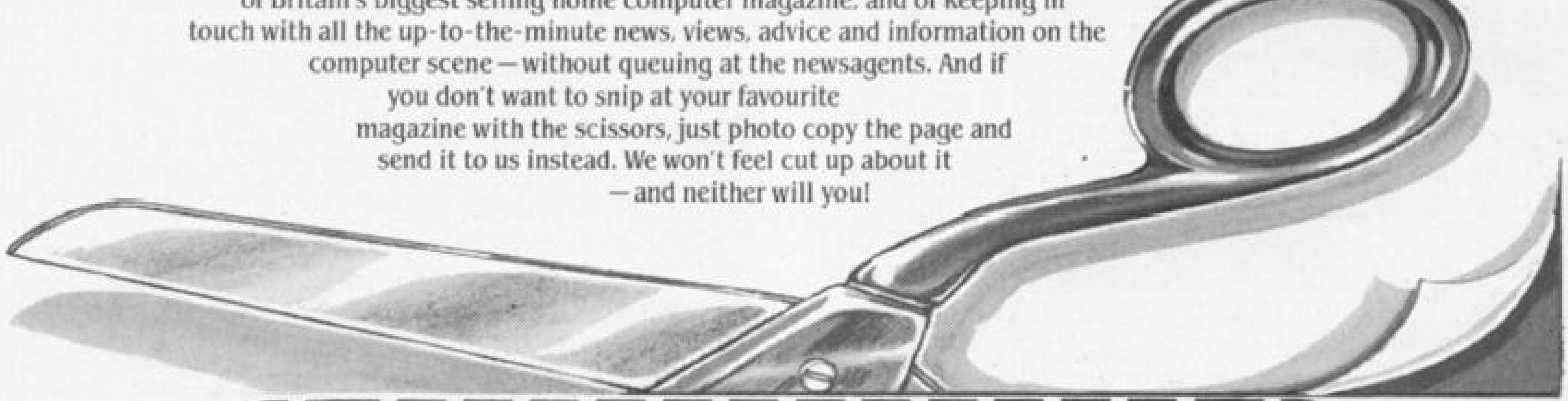
```
46000 1,1,1,1,1,1,1,1,                  : 8
46008 1,0,0,0,0,0,0,1,                  : 2
46016 1,0,6,7,0,0,1,1,                  : 16
46024 1,1,1,1,1,1,9,1,                  : 16
46032 1,0,0,0,0,0,8,1,                  : 10
46040 1,1,1,0,0,0,0,1,                  : 4
46048 1,0,0,1,1,1,0,1,                  : 5
46056 1,0,1,1,0,0,0,1,                  : 4
46064 1,0,0,1,1,0,1,1,                  : 5
46072 1,0,0,0,0,0,0,1,                  : 2
46080 1,2,2,2,0,0,0,1,                  : 8
46088 1,2,2,2,0,0,0,1,                  : 8
46096 1,1,1,1,1,0,0,1,                  : 6
46104 1,0,1,0,0,0,1,1,                  : 4
46112 1,0,0,0,0,0,1,1,                  : 3
46120 1,0,1,1,1,0,1,1,                  : 6
46128 1,0,1,1,0,0,0,1,                  : 4
46136 1,0,0,1,2,0,1,1,                  : 6
46144 1,0,0,1,2,2,0,1,                  : 7
46152 1,1,0,1,1,1,2,1,                  : 8
46160 1,0,0,0,0,0,1,1,                  : 3
46168 1,1,1,1,1,0,0,1,                  : 6
46176 1,0,0,0,0,0,0,1,                  : 2
46184 1,0,0,1,1,1,1,1,                  : 6
46192 1,0,0,0,0,0,0,1,                  : 2
46200 1,1,1,0,0,1,2,1,                  : 7
46208 1,1,0,0,0,1,2,1,                  : 6
46216 1,0,0,1,0,1,2,1,                  : 6
46224 1,0,0,1,2,0,2,1,                  : 7
46232 1,0,1,1,1,1,1,1,                  : 7
46240 1,0,0,0,0,0,0,1,                  : 2
46248 1,0,0,0,1,2,2,1,                  : 7
46256 1,0,0,1,0,2,2,1,                  : 7
46264 1,0,0,0,0,1,1,1,                  : 4
46272 1,1,1,0,0,0,1,1,                  : 5
46280 1,0,0,0,1,0,0,1,                  : 3
46288 1,2,1,0,1,1,2,1,                  : 9
46296 1,2,0,0,0,0,2,1,                  : 6
46304 1,1,1,0,0,0,0,1,                  : 4
46312 1,2,2,2,0,0,0,1,                  : 8
46320 1,1,1,1,1,0,1,1,                  : 7
46328 1,1,1,0,0,0,0,1,                  : 4
46336 1,0,0,0,0,1,2,1,                  : 5
46344 1,2,0,0,1,1,2,1,                  : 8
46352 1,1,0,0,1,1,0,1,                  : 5
46360 0,0,0,0,0,0,0,1,                  : 1
46368 0,0,0,0,0,0,2,1,                  : 3
46376 0,2,0,0,2,2,1,1,                  : 8
46384 0,1,1,1,1,1,1,1,                  : 7
46392 0,1,1,1,1,1,1,1,                  : 7
46400 0,1,1,1,1,1,0,1,                  : 6
46408 2,1,1,1,1,1,1,1,                  : 9
46416 2,0,0,0,1,0,0,0,                  : 3
46424 1,0,1,0,1,0,1,0,                  : 4
46432 1,0,1,0,1,0,0,0,                  : 3
46440 1,0,0,0,1,0,1,0,                  : 3
46448 1,1,1,0,9,1,1,1,                  : 15
46456 1,0,0,0,0,0,0,1,                  : 2
46464 1,2,2,2,2,2,2,1,                  : 14
46472 1,2,2,2,2,2,2,1,                  : 14
46480 1,2,2,2,2,2,2,1,                  : 14
46488 1,2,2,2,2,2,2,1,                  : 14
46496 2,2,2,2,2,2,2,1,                  : 15
46504 2,2,2,2,2,2,2,1,                  : 15
46512 1,1,1,1,1,1,1,1,                  : 8
46520 0,0,33,176,179,17,200,175,        : 780
46528 1,8,2,237,176,201,0,243,          : 868
46536 33,200,175,237,75,102,234,9,      : 1065
46544 22,0,30,0,70,229,213,4,           : 568
46552 33,248,155,17,72,0,25,16,         : 566
46560 253,34,99,234,209,225,237,83,     : 1374
46568 95,234,237,83,97,234,35,229,      : 1244
46576 213,205,48,182,209,225,28,28,     : 1138
46584 28,62,22,187,48,214,20,20,        : 601
46592 20,62,19,186,48,204,251,201,      : 991
46600 64,136,208,24,96,168,240,56,      : 992
46608 128,200,16,88,0,0,0,0,            : 432
46616 0,0,0,0,66,122,7,6,               : 201
46624 66,66,5,69,6,121,4,4,             : 341
46632 6,0,0,0,0,0,0,0,                  : 6
46640 205,61,182,205,81,182,205,97,     : 1218
46648 182,205,105,182,201,58,96,234,    : 1263
46656 1,0,8,33,0,64,22,7,               : 135
46664 186,216,200,30,8,147,9,24,        : 820
46672 247,71,245,175,184,40,8,241,      : 1211
46680 17,32,0,25,16,253,201,241,        : 785
46688 201,237,75,97,234,6,0,9,          : 859
46696 201,79,237,91,99,234,8,217,       : 1166
46704 6,3,175,217,8,6,8,26,             : 449
46712 119,19,35,26,119,19,35,26,        : 398
46720 119,19,197,1,234,0,9,193,         : 792
46728 16,237,8,217,5,184,40,26,         : 733
46736 217,8,12,167,197,1,224,7,         : 833
46744 237,66,193,62,8,185,32,213,       : 996
46752 197,1,0,7,9,193,14,0,             : 421
46760 24,203,217,8,253,33,96,234,       : 1068
46768 33,224,87,253,70,0,4,17,          : 688
46776 32,0,25,16,253,233,78,1,          : 638
46784 6,0,9,22,0,58,99,234,             : 428
46792 221,33,8,182,221,86,0,221,        : 972
46800 35,186,32,248,221,126,19,6,       : 873
46808 3,17,30,0,119,35,119,35,          : 358
46816 119,25,16,248,201,0,205,243,      : 1057
46824 182,205,7,183,205,23,183,205,     : 1193
46832 31,183,201,58,105,234,1,0,        : 813
46840 8,33,0,64,22,7,186,216,           : 536
46848 200,30,8,147,9,24,247,71,         : 736
46856 245,175,184,40,8,241,17,32,       : 942
46864 0,25,16,253,201,241,201,237,      : 1174
46872 75,106,234,6,0,9,201,79,          : 710
46880 8,217,6,3,175,217,8,6,            : 640
46888 8,62,0,119,35,62,0,119,           : 405
46896 35,62,0,119,197,1,234,0,          : 648
46904 9,193,16,237,8,217,5,184,         : 869
46912 40,26,217,8,12,167,197,1,         : 668
46920 224,7,237,66,193,62,8,185,        : 982
46928 32,213,197,1,0,7,9,193,           : 652
46936 14,0,24,203,217,8,201,0,          : 667
46944 0,0,0,0,0,0,0,0,                  : 0
```

Sprite code.

```
40074 0,255,31,243,255,63,251,255,      : 1353
40082 191,251,255,191,247,255,191,247,  : 1828
40090 255,31,247,0,223,224,31,224,      : 1235
40098 14,63,252,255,127,254,255,63,     : 1283
40106 254,255,31,254,255,224,0,252,     : 1525
40114 255,230,123,255,247,7,255,247,    : 1619
40122 127,255,128,255,0,0,127,31,       : 923
40130 240,0,127,252,255,127,254,255,    : 1510
40138 127,254,255,63,252,126,0,0,       : 1077
40146 0,0,127,0,3,207,128,14,           : 479
40154 35,160,28,255,120,29,82,252,      : 961
40162 61,255,252,51,255,254,127,255,    : 1510
40170 190,127,224,190,126,9,190,127,    : 1183
40178 251,222,127,247,46,119,255,238,   : 1505
40186 79,251,222,127,247,254,127,239,   : 1546
40194 254,127,223,46,32,215,206,39,     : 1162
40202 255,238,19,255,134,31,255,244,    : 1431
40210 31,255,132,15,255,248,0,104,      : 1040
40218 0,0,52,0,0,26,0,0,                : 78
40226 13,0,0,6,128,0,3,64,              : 214
40234 0,1,160,0,0,208,0,0,              : 369
40242 110,0,0,63,0,0,61,0,              : 234
40250 0,57,0,0,31,0,0,14,               : 102
40258 0,0,0,0,0,0,0,0,                  : 0
40266 0,0,0,0,0,0,0,0,                  : 0
40274 0,0,0,0,0,0,0,0,                  : 0
40282 0,0,0,0,0,0,0,0,                  : 0
40290 0,0,0,0,0,0,0,0,                  : 0
40298 0,64,0,125,192,0,254,128,         : 763
40306 0,137,0,15,153,0,15,254,          : 594
40314 0,3,252,0,5,120,0,6,              : 386
40322 254,0,5,115,0,13,99,0,            : 486
40330 10,227,0,14,135,0,4,207,          : 597
40338 0,24,239,56,0,127,224,0,          : 670
40346 62,48,0,118,156,7,239,128,        : 758
40354 7,239,0,1,222,0,0,0,              : 469
40362 0,0,0,0,0,0,0,2,                  : 2
40370 0,0,3,190,0,1,127,0,              : 321
40378 0,185,0,0,153,240,0,127,          : 705
40386 240,0,63,192,0,30,160,0,          : 685
40394 127,96,0,206,160,0,198,176,       : 963
40402 0,199,80,0,227,112,0,231,         : 849
40410 32,28,239,24,7,254,0,12,          : 596
40418 124,0,56,110,0,1,247,0,           : 538
40426 0,247,192,0,123,192,0,109,        : 863
40434 0,0,187,128,1,111,192,2,          : 621
40442 192,224,3,56,103,3,20,224,        : 825
40450 3,129,97,1,223,193,1,190,         : 837
40458 192,0,215,128,0,237,128,0,        : 900
40466 118,0,1,190,192,3,223,224,        : 950
40474 7,227,240,16,127,188,6,127,       : 934
40482 152,0,95,128,0,79,128,0,          : 582
40490 39,0,0,63,0,0,97,128,             : 327
40498 0,225,192,1,243,224,0,0,          : 885
40506 0,63,255,252,96,0,6,203,          : 875
40514 162,58,171,34,43,58,34,41,        : 601
40522 43,187,185,128,0,1,131,229,       : 904
40530 1,130,167,1,130,33,1,128,         : 591
40538 0,1,128,0,1,157,207,177,          : 671
40546 149,74,161,213,232,185,64,0,      : 1078
40554 1,107,60,5,34,32,5,43,            : 287
40562 45,221,41,37,85,51,61,221,        : 762
40570 16,0,1,31,255,255,0,22,           : 580
40578 0,0,44,0,0,88,0,0,                : 132
40586 176,0,1,96,0,2,192,0,             : 467
40594 5,128,0,11,0,0,118,0,             : 262
40602 0,252,0,0,188,0,0,156,            : 596
40610 0,0,248,0,0,112,0,0,              : 360
40618 0,0,0,0,0,0,0,0,                  : 0
40626 0,0,0,0,0,0,0,0,                  : 0
40634 0,0,0,0,0,0,0,0,                  : 0
40642 0,0,0,0,0,0,255,255,              : 510
40650 255,170,0,129,170,174,52,170,     : 1120
40658 166,183,170,238,181,128,0,0,      : 1064
40666 255,255,255,247,241,247,244,119,  : 1863
40674 39,245,113,39,255,255,255,255,    : 1456
40682 255,255,183,143,251,149,210,75,   : 1521
40690 132,214,73,255,255,255,128,16,    : 1328
40698 1,186,152,127,171,149,73,171,     : 1029
40706 149,109,171,149,73,186,151,73,    : 1061
40714 128,16,1,255,255,255,0,127,       : 1037
40722 0,1,128,192,6,96,48,25,           : 496
40730 206,108,32,56,146,110,224,146,    : 1026
40738 25,141,44,115,51,30,198,193,      : 815
40746 66,129,0,1,158,247,189,82,        : 872
40754 148,32,82,151,56,30,148,32,       : 679
40762 16,148,33,80,244,45,98,0,         : 664
40770 26,41,200,38,32,8,140,18,         : 523
40778 172,132,26,231,48,11,16,32,       : 686
40786 16,236,192,0,3,0,0,0,             : 445
40794 0,0,0,0,0,0,0,0,                  : 0
40802 0,0,0,0,0,0,0,0,                  : 0
40810 0,206,0,1,155,128,1,42,           : 537
40818 96,1,44,16,2,25,16,2,             : 202
40826 179,96,2,168,192,0,76,0,          : 711
40834 0,67,0,0,44,0,0,0,                : 111
40842 0,0,0,0,0,0,0,0,                  : 0
40850 0,0,0,0,0,0,0,0,                  : 0
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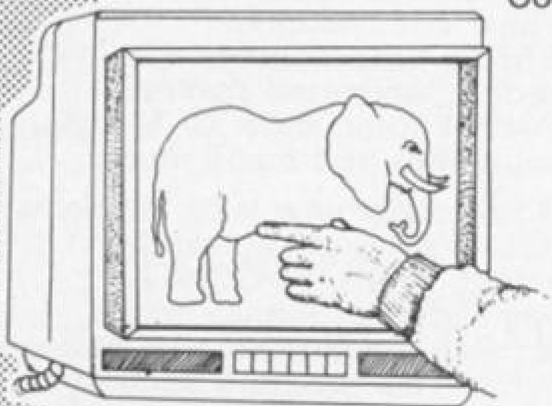
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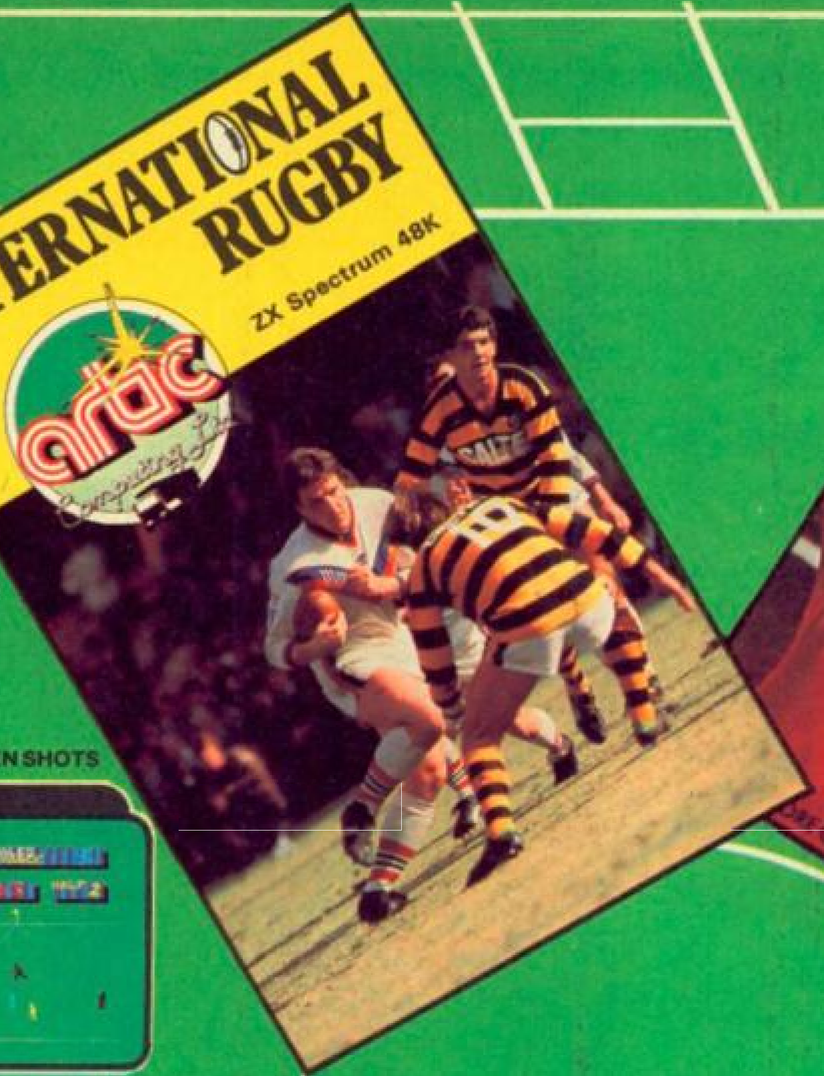
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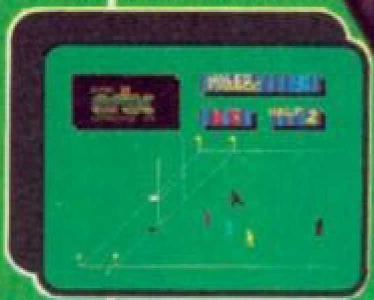
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Each of the programs are inter-active and together they form the most accomplished graphics toolkit you will find on the market today.

But you can also use each of them separately, as each are self-contained and cover a specific area of graphics programming.

With Print 'n' Plotter's 'GRAPHICS SUITE', everything is made so simple you won't believe it.



Just a few of the things you can do...

PAINTPLUS (GRAPHICS SUITE 1)

If you want to produce fantastic screen graphics or UDG's on your Spectrum, then you will find PAINTPLUS not only a complete graphics toolkit . . . but also the simplest to use at every level.

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As well as drawing, PAINTPLUS has a tremendous UDG section. It also has UDG "grabbing" from screen as well as full facilities for defining, saving and loading UDG sets.

The Organiser section of the program enables you to automatically store multiple screen graphics or multiple UDG banks.

PAINTPLUS comes with a demo of screens, animation and alternative character sets, plus a copy of Print 'n' Plotter PICTURE BOOK – 100 pages of instructions, hints, tips, listings and related graphics information.

SCREEN MACHINE (GRAPHICS SUITE 2)

SCREEN MACHINE is *the* graphics manipulator.

Use it when you want to take your graphics and turn them into professional machine coded data for use in BASIC or M/Code programs.

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SCREEN MACHINE will compress the memory consumption of your graphics to cram even more into the computer's memory –

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These include ENLARGE, REDUCE, RELOCATE TO OTHER PARTS OF THE SCREEN, STEP AND REPEAT, BLEND SCREENS TOGETHER, RECOLOUR SELECTIVELY OR GLOBALLY, FLIP SCREEN, etc.

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SCREEN MACHINE also comes with a copy of PICTURE BOOK and a demo that's so good you can't believe it.

ART-O-MATIC (GRAPHICS SUITE 3)

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The exact amount of compression possible depends on your graphics, but up to 99% is possible and an average of 85%-90% is usual.

ART-O-MATIC is a complete graphics drawing program, so you can produce your works of art and compile at the same time.

The instruction book and demo that comes with the program show you *everything* you need to know about cramming great graphics into your Spectrum.

SPRITE MACHINE (GRAPHICS SUITE 4)

There have been a number of programs called Sprite Generators. Most of these are self-contained and not a great deal of use to people who want to use Sprites in their own programs.

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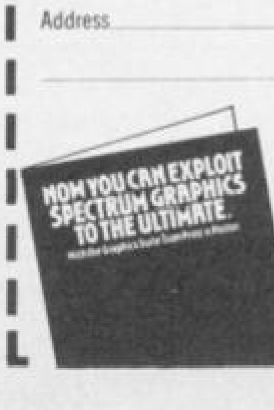
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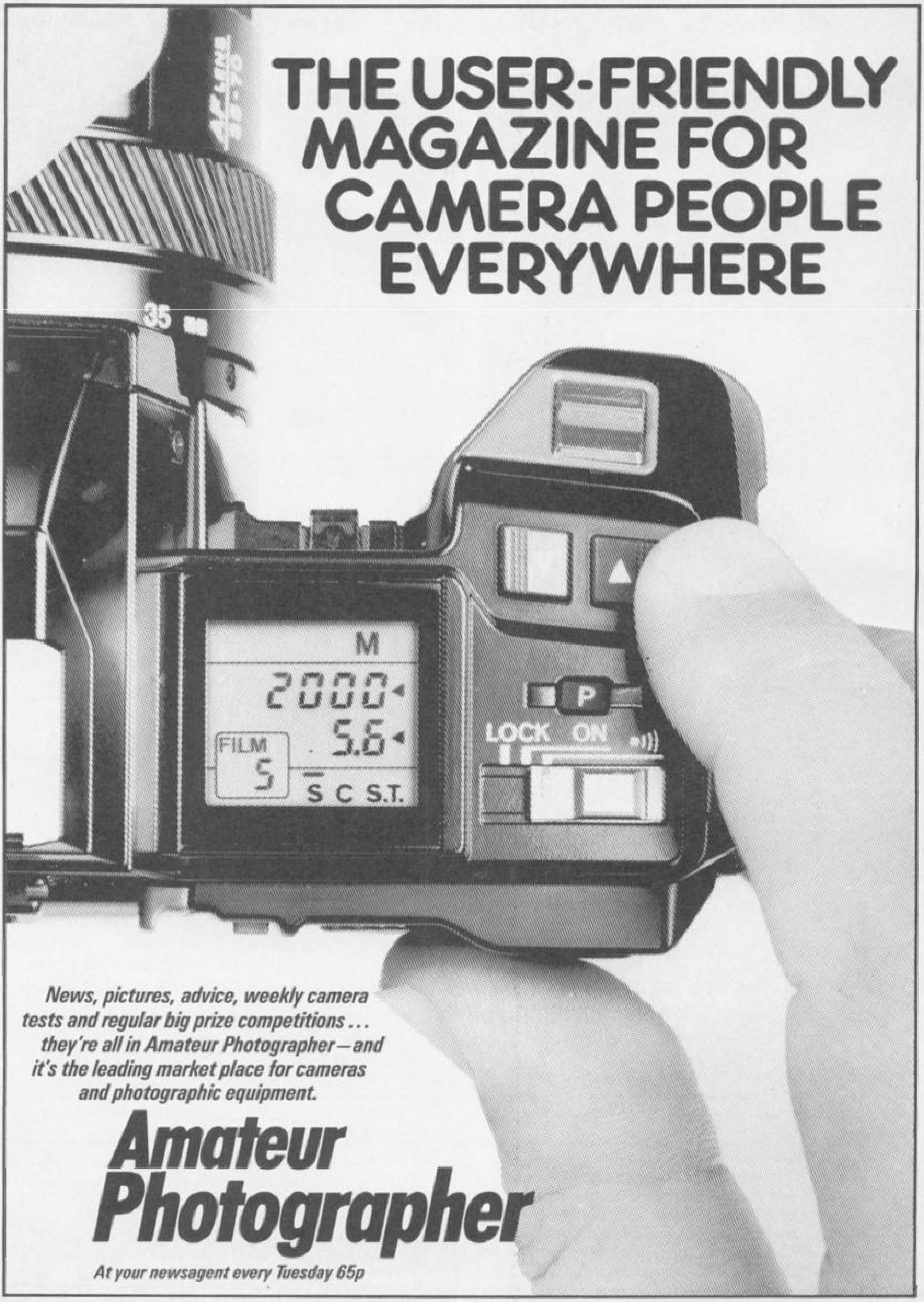
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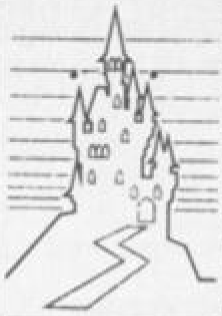
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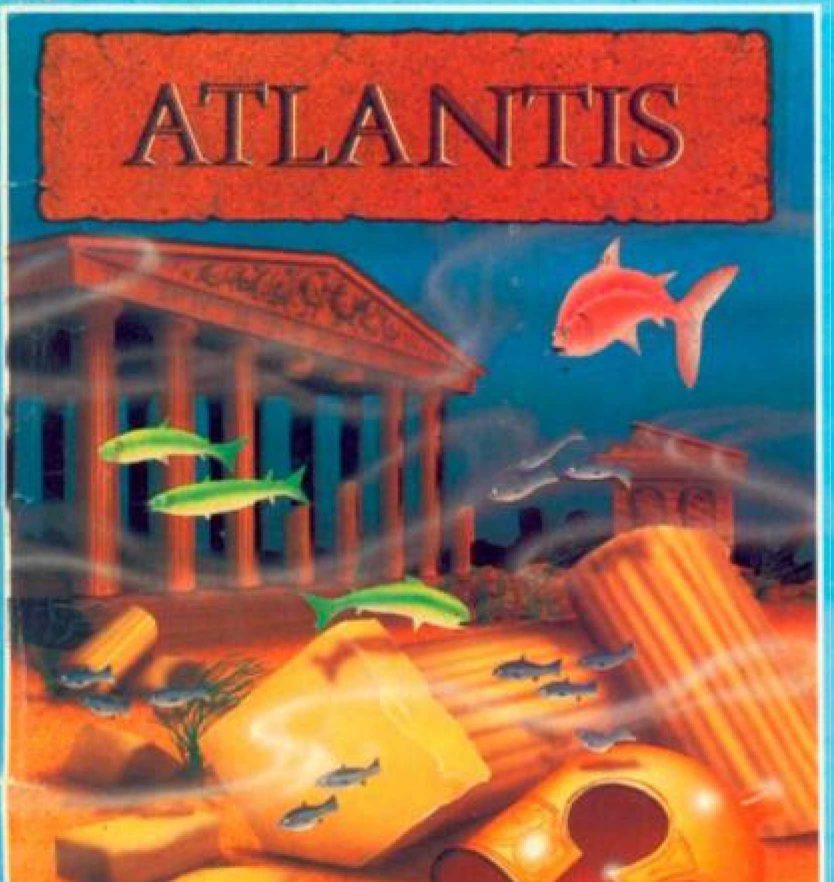
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